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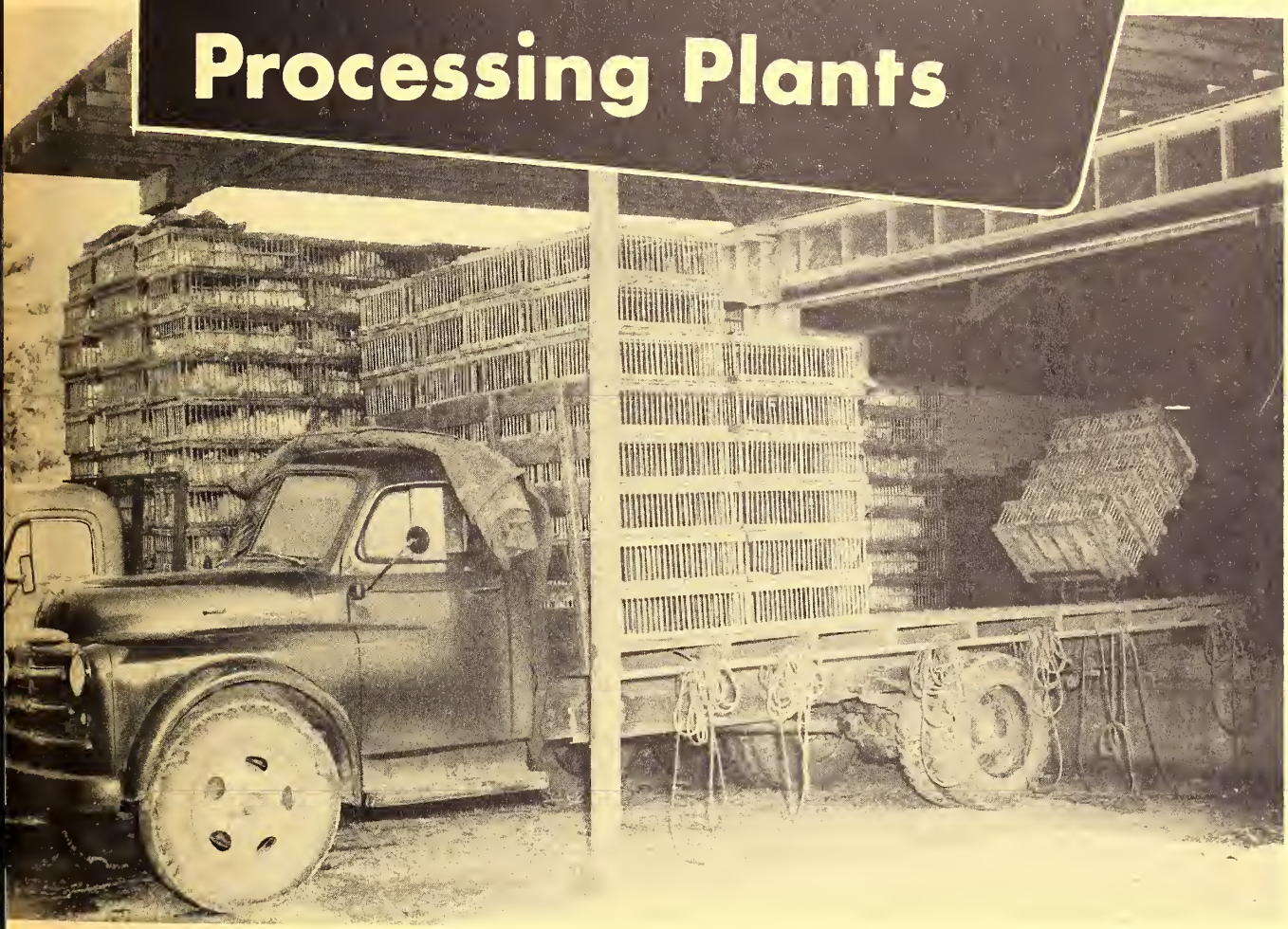
Marketing GEORGIA BROILERS Through Commercial Processing Plants



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U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
in cooperation with
Georgia Experiment Station

Marketing Research Report No. 83

Washington, D. C.
March 1955

PREFACE

This publication is the result of one phase of the work done under a cooperative project between the Georgia Experiment Station, represented by W. T. Fullilove, and the Marketing Research Division, Agricultural Marketing Service, U. S. Department of Agriculture, represented by D. B. DeLoach.

The information in this publication was provided primarily by managers of broiler processing firms in north Georgia. Gordon Sawyer, executive secretary of the Georgia Poultry Federation, assisted in developing the study and reviewed the draft manuscript.

O. C. Hester, who was with the former Bureau of Agricultural Economics, and W. W. Harper, Georgia Experiment Station, assisted in planning this study. W. M. Bruce, Agricultural Engineering Research Branch, Agricultural Research Service, U. S. Department of Agriculture, prepared the layouts on pages 24 and 31 and assisted with the description of typical processing operations. H. D. White, Department of Agricultural Engineering, University of Georgia, Athens, Georgia, provided the photographs for this publication. Q. F. Dallavalle, AMS, assisted in the field work.

The study on which this report is based was conducted under authority of the Agricultural Marketing Act of 1946 (RMA, Title II).

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SUMMARY

Broiler processing plants in north Georgia aided in the efficient marketing of the 100 million dollars' worth of broilers produced in Georgia in 1953 and contributed about 30 million dollars to the nonfarm income of that State.

Processing plants in north Georgia are relatively large, 13 of the 28 commercial plants usually processing 2,750 or more broilers an hour. Most of the plants were built recently and are modern in every way. No letdown in the rate of installation has occurred since 1946, and at least three new plants started operating in the summer of 1953.

Processing capacity on a single-shift basis has exceeded local production in north Georgia every year since 1946. At times plants have had to operate overtime in order to process all available supplies. These periods made up a relatively small part of the year in 1952, however.

The sources from which live birds were obtained and the manner of assembling them seemed to be related to the distance of the farm from the plant and to the newness of the plants. For north Georgia as a whole, more than 80 percent of the supply of live birds was assembled from farms less than 40 miles from the plants. In the Gainesville-Canton and Atlanta sections, a major part of the live broilers was obtained from distances of less than 40 miles from the plants, and processing plants were comparatively older. In these areas processors financed the production of roughly one-third of their processed output. In general, they paid for the broilers on the basis of farm weights and hauled them to the plants.

When independent feed dealers financed birds bought by processors, as, for example, in the Gainesville-Canton section, the feed dealers hauled the birds to the plants and settled for them on the basis of plant weights. The same was true in the Atlanta section except that most prices were for farm-weighed birds. Processors in the Athens section financed the production of practically none of their supplies, yet they hauled birds from the farms and settled on the basis of farm weights.

In 1952 most plants in north Georgia sold only ready-to-cook, whole, ice-packed broilers. Seventeen percent of all processed broilers were cut up and frozen. Some processors reported a growing demand by the trade for cut-up, fresh, tray-packed broilers.

Processors in the Atlanta section, which has a large urban population, sold most of their output in 1952 to independent and chain retail stores and to restaurants in the section and in other nearby markets. In the Athens and Gainesville-Canton sections, which have smaller urban populations, processors sold mostly to wholesale receivers in distant markets. Sixty-eight percent of the output in north Georgia in 1952 was sold to wholesalers, 18 percent to chain stores, and 14 percent to independent retail stores and restaurants. Receivers in the North Central States were the largest buyers of north Georgia broilers, taking at least half of the output of processors in the area. After the North Central States as a group, Georgia and Florida ranked second and third, respectively, as markets.

The chief characteristic of labor use on north Georgia broiler processing lines having large outputs was the assignment of only one simple operation to each worker. The high output per man-hour, apparently feasible for many of these special assignments in broiler processing, permits fast line speed and close shackle spacings. The average output on the large lines was 34 birds per man-hour. Conversely, the output per man-hour on lines having small outputs and few special assignments was 28 birds.

In general, broiler processing in north Georgia seemed to be efficient. There was some deviation from the general trend towards increased efficiency at high levels of output. However, these deviations were explainable by the organization of the crews, and probably by equipment, plant layout, and worker skill. From a theoretical examination of the efficiency of each person being given only one assignment, it was apparent that failure to operate at the maximum rate for a given crew or failure to use a properly balanced crew would cause disadvantages in labor costs.

Large plants in the area seemed to have a number of cost advantages in processing and possibly in assembling and selling. These plants utilized more of their capacity in 1952 than did smaller plants. This should have resulted in lower overhead costs per pound processed. Output per man-hour of labor and office workers and executives was higher on the average for the large lines. The large lines also used less conveyor per unit of capacity than did the smaller ones.

Opportunities for reductions in costs present themselves in two ways. First, costs for plant overhead on a per-pound basis can probably be reduced if the plant output can be increased by increasing the hourly capacity of the line or by working additional hours. Firms already active in broiler processing should consider the possibility of increased utilization of existing capacity through the use of the plant for more than 40 hours a week on a double-shift basis. If this practice were followed, it is estimated that production in the area could almost be doubled without installing new facilities. This alternative is practicable only if increased supplies of broilers can be obtained without increased costs of assembly and if market outlets are available.

A second possible way of reducing costs is to make adjustments in the number of persons working on the processing line and in the assignments given to each, so that each works insofar as possible at high efficiency. Savings might also be made by improvements in types of machinery and improved plant layout and facilities.

MARKETING GEORGIA BROILERS THROUGH COMMERCIAL PROCESSING PLANTS

By John O. Gerald and Humbert S. Kahle
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INTRODUCTION

This report is based on the third phase of a study of broiler marketing problems in Georgia. The first two phases dealt with the market structure, marketing practices and policies of producers and feed dealers, and the integration of production and marketing functions 1/.

Broiler processing in Georgia in 1953 contributed roughly 30 million dollars in wages, salaries, and other payments to the income of the State. This industry is operating under competitive conditions conducive to low costs, and these low processing costs are reflected in prices paid by consumers or to producers.

Objectives

This phase of the study was begun to assemble economic information relating to functions involved in broiler processing and to factors affecting efficiency of broiler processing. The study was limited primarily to actual and potential plant capacity and related use of labor and machinery. It involved, however, a consideration of practices used by processors in assembling live birds, in organizing the labor force, and in handling the processed product. This information is used to assess the overall capacity of the Georgia processing industry, to reach preliminary conclusions regarding economic costs at various levels of plant output, to study labor input-outputs, and to develop a useful description of processing practices that affect plant efficiency.

Method

The survey included the 28 commercial processing plants for broilers that were in operation at the end of 1952 in the north Georgia broiler area. A commercial plant was defined as one normally processing 1,000 broilers or more per 8-hour day. The plant managers were interviewed regarding plant capacities, total output, marketing practices, and market areas. The plant foremen were asked to assist in delineating areas of work in the plant and in tabulating the tasks performed by each work crew. Second visits were made to several plants in order to verify the observed rates of work.

1/ Hester, O. C., and Harper, W. W., The Function of Feed-Dealer Suppliers in Marketing Georgia Broilers. Ga. Expt. Sta. Bull. 283. Athens, Ga. 40 pp., illus. August 1953.

Records were obtained from 23 of the 28 plants visited. The data for these 23 plants were used to estimate comparable data for the 5 nonrespondents so that the total plant capacity for the whole area could be estimated.

BROILER PRODUCTION AND PROCESSING IN GEORGIA, 1934-52

Commercial production of broilers in Georgia has increased from 400,000 head in 1934 to 112,621,000 in 1952. This great increase came about through slow but steady growth up to 1940, rapid growth from 1940 to 1945, and tremendous increases from 1948 through 1952. This growth moved Georgia from 23d State in number of broilers produced in 1934 to first place in 1951-53. In 1934 broilers accounted for 4.5 percent of the cash farm income in Georgia from poultry and eggs and 0.1 percent of total farm income. By 1952 broilers accounted for 72.8 percent of the cash farm income from poultry and eggs and 13.7 percent of total farm income. This growth put broilers in second place as a producer of farm income in Georgia, cotton remaining in first place.

At first, production tended to be concentrated in a small section north of Atlanta. This area has been expanded until at present it includes about 30 counties in north Georgia (fig. 1). This growth occurred through increased density and size of producing units as well as through an expansion of the area. The industry developed in an area of small farms having available surplus labor. The limited capital resources available made a farm enterprise that would have a fast capital turnover especially attractive.

As housing and other fixed investments for raising broilers were minor, the costs of baby chicks and feed were the limiting factors on size of individual units. These costs in 1952 amounted to $700 or more per 1,000 broilers produced. This restriction, however, became ineffective as the financing of feed and baby chicks was taken over by milling companies, local feed dealers, hatcheries, and poultry processors.

Early in the development of the broiler industry in Georgia, marketing was relatively simple. Retail markets in the immediate area were able to handle with little difficulty the limited quantities of live broilers delivered to them by producers. But, beginning in about 1940, production rose at a rapid rate and new markets were needed (fig. 2). Inasmuch as shrinkage and costs of hauling live broilers increase as distance increases and as the largest markets were outside the South, marketing in live form was impractical.

Processing in the area of production, therefore, became necessary for most of the broilers produced in Georgia. Commercial processing plants began to operate in north Georgia as early as 1932, but their services were not so necessary to producers as they are today. Up to 1939 per capita broiler production in Georgia was less than 53 percent of the United States average of 2.3 pounds live weight. By 1953 per capita production in Georgia had increased to 5.2 times the United States average of 19 pounds. The result of this increase on the use of out-of-State markets is indicated in figure 3.

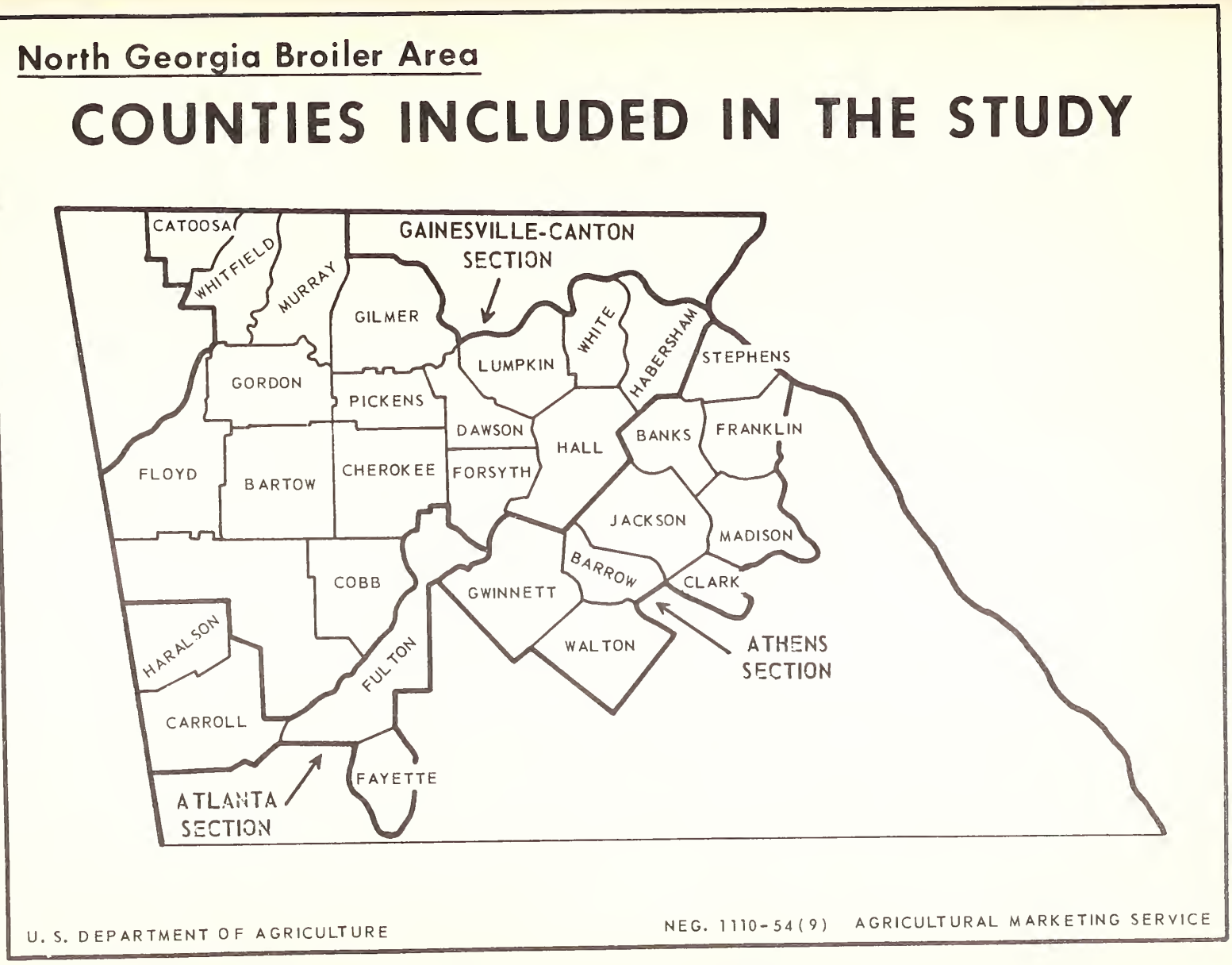


Figure 1.--Counties included in the north Georgia broiler area.

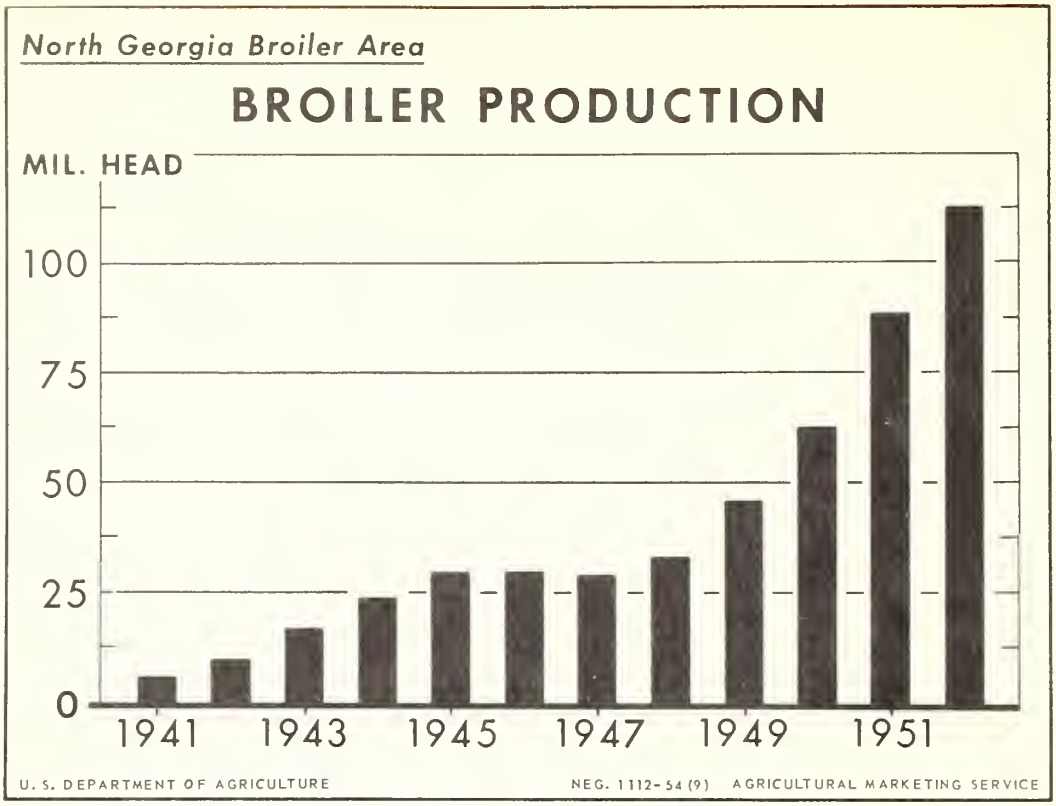


Figure 2.--Growth of broiler production in the north Georgia broiler area, 1941-52.

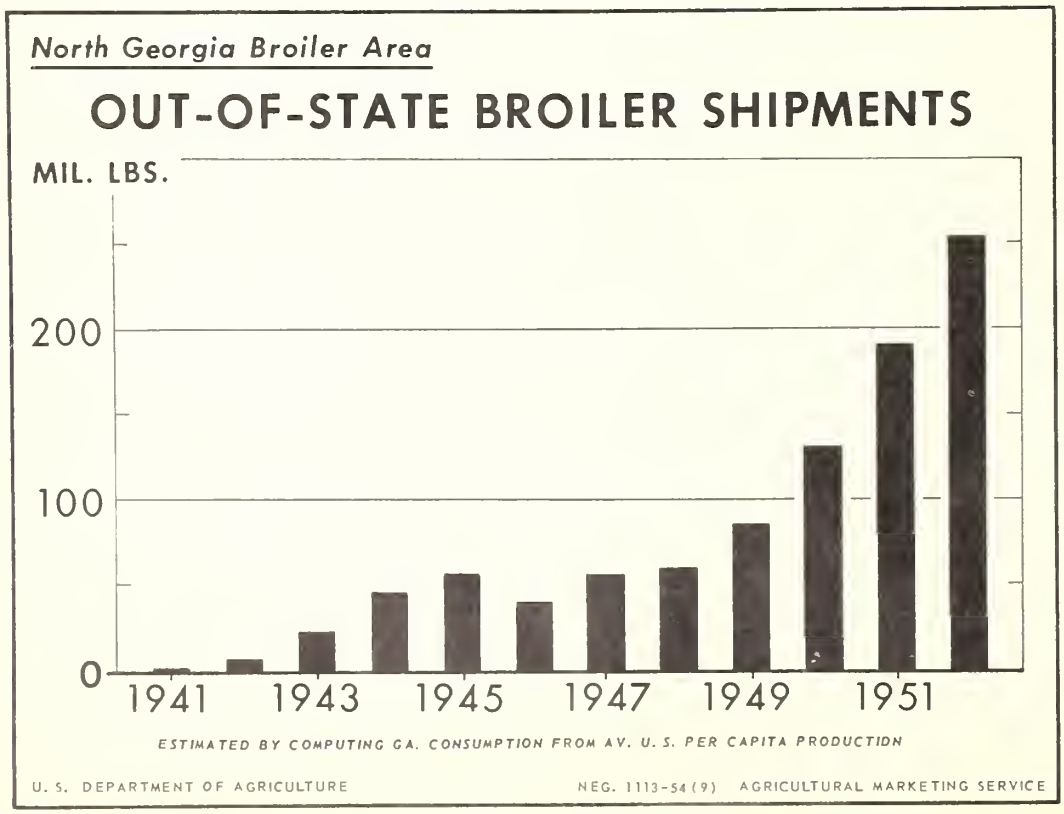


Figure 3.--Estimated out-of-State shipments of broilers, north Georgia broiler area, 1941-52.

Until recently most of this excess over local needs was sold in Florida and other Gulf States markets, but now more than 60 percent of the broilers shipped out of Georgia go to markets in the North Central States. One of the factors contributing to this shift in out-of-State markets was the rapid growth of broiler production in new areas in the South where production increased from 46 million in 1947 to 226 million in 1952. In the established broiler areas of Georgia, Virginia, and Arkansas, broiler production jumped from 68 million head in 1947 to 236 million in 1952. During this same period the number of consumers in the South increased very little.

Broiler processing plants in the area of production are important to producers and consumers because they efficiently convert the live product into a form that is easily transported and marketed. In addition, processing operations add to the income and purchasing power of the State in which they are located.

At the time of this survey in February 1953, the spread between prices paid for live birds and prices received for eviscerated birds by Georgia processors was approximately 17 cents. However, not all of this amount was realized as income to the State, since roughly 30 percent of the live weight was composed of blood, feathers, head, feet, and entrails which were not salable at prices equivalent to those of eviscerated broilers. Although there was some use made of this so-called waste material in the State, it represented little value to the individual processor. Roughly, only eight cents of the spread was actually obtained by the processors for use in paying labor, transportation costs, overhead and depreciation expenses, and for profits. This sum represented a 30-million-dollar addition to the income of Georgia in 1953.

A rough approximation of the distribution of this sum can be made by referring to a cost accounting of the records of a number of broiler processing plants (table 1). The figures shown represent an allocation of the processing costs for eviscerated broilers, which excludes acquisition, feeding, shrinkage, hauling-out costs, and profits. The costs for eastern, ice-packed, eviscerated broilers probably come closest to approximating costs in Georgia.

Table 1.- Processing costs per pound of straight-line eviscerated broilers and fryers, 1950-51

Items of cost	Eastern ice packed	Eastern frozen	Midwest ice packed	Midwest dry packed	W. S. Cent. ice packed
	Dollars per pound eviscerated weight basis				
Killing, dressing, pinning, eviscerating, cooling, and packing labor	0.0264	0.0382	0.0335	0.0421	0.0281
Plant overhead	.0110	.0241	.0163	.0146	.0249
Miscellaneous 1/	.0088	.0128	.0171	.0174	.0243
Byproduct income	(.0001)	(.0025)	(.0013)	(.0012)	(.0011)
Sub-total	.0462	.0726	.0656	.0729	.0762
Average packing cost	.0130	.0181	.0113	.0160	.0118
Total	.0601	.0907	.0769	.0889	.0880

1/ Includes the following wherever applicable: Grading and inspection, freezing labor, warehouse and shipping expense (but not outbound transportation and freezing costs), selling expense (plant only), general and administrative expense (plant only). This does not include shrinkage costs.

Source: Reproduced from a speech by George B. Rogers, OPS economist, before the Poultry Industry Fact Finding Conference of 1953.

Location of Processing Plants

For purposes of analysis the north Georgia area was divided into three sections quite different in characteristics (figure 1). Six of the plants were located in the Atlanta section (table 2). Production in this section is low, plants are predominantly small, and local outlets are utilized. Seven plants were located in the Athens section; two of which started operating during 1952. One plant in this section discontinued operations during 1951, and another was about to begin operations at the time of the survey. Therefore, records from these two were not available. Plants in this section varied in size and in outlets serviced. The Gainesville-Canton section had 15 plants, many of which were large, modern plants servicing distant outlets to a great extent. Production in this section is very dense (fig. 4), as estimated from the 1949 Census of Agriculture and from reported placements by feed dealers of baby chicks in each section in 1951.

Table 2.- Commercial broiler-processing plants, by normal hourly output and by sections, north Georgia, 1952

Area and section	Plants by broiler output per hour				Average broiler output per hour
	250-1,249	1,250-2,749	2,750 and over	Total	
	Number	Number	Number	Number	Number
North Georgia					
Atlanta	4	1	1	6	1,188
Athens	3	1	3	7	2,633
Gainesville-Canton	1/ 3	2/ 3	2/ 9	15	2,631
Total or average	10	5	13	28	2,322

1/ One plant estimated.
2/ Three plants estimated.

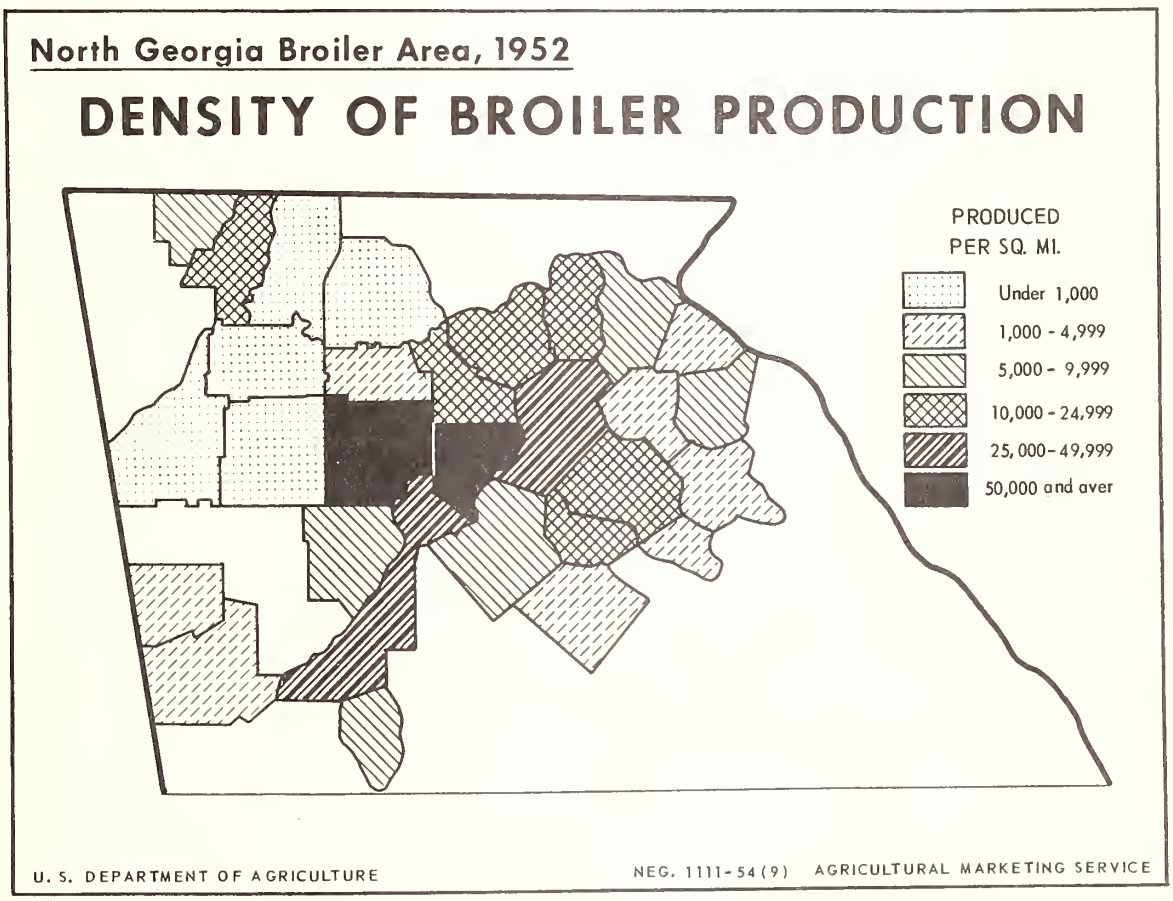


Figure 4.--Location and estimated density of broiler production by counties and sections in the north Georgia broiler area, 1952.

Maximum Hourly Output

The maximum hourly output of broiler processing plants in Georgia was obtained from plant managers. However, at the time of the survey very few plants were operating at a maximum. Some managers indicated that the maximum hourly output rates were calculated by the equipment companies, and others stated that the maximums quoted were hypothetical only. Only 2 of the 23 plant managers stated that any deviation from the "normal output" rate occurred. One plant manager said that the output was changed occasionally in order to maintain a uniform quality, and one said that daily output was a function of the speed of the line, hours of operation being a constant. This plant financed a large number of broiler producers and was in an area where production was in excess of processing capacity. Therefore, it could probably obtain a somewhat constant supply and any change in output was for quality control or due to absenteeism rather than to variation in supplies.

For all practical purposes, the normal output rate is a better measure of a plant's processing capacity than is the maximum output rate. The maximum capacity is a potential that is not utilized under present conditions. A few plants apparently operated more than 8 hours per day at times but none operated more than one shift.

Age of Plants

Of the plants in operation at the end of 1952, 1 started operating in 1932; 2 were established at the start of the war in 1941 and 1942; and the remainder have been put into operation since 1944 at the rate of 2 or 3 a year.

Practically all the growth in processing facilities therefore has occurred since 1945. The relative rates of growth have been quite different for the three sections since 1945 (fig. 5). The Atlanta section has had very little growth during this period. The newness of the processing industry in the Athens section is indicated by the fact that all plants in operation in the spring of 1953 started operations during or after 1947. The Gainesville-Canton section is by far the most important one in broiler production and processing and has grown tremendously since 1945.

Physical Facilities

Facilities for processing broilers in the older and smaller plants in north Georgia were in many instances improvised. Of the 23 plants for which information was obtained, 6 were in structures designed as storage facilities for feed, cotton, or equipment; 1 was in a farmers' market; and 1 was in the basement of a feed store. Fifteen plants were designed for the purpose of processing broilers. Most of these were of concrete, concrete block, brick, or steel and aluminum construction. Six had either wood or wood and aluminum siding with concrete foundations.

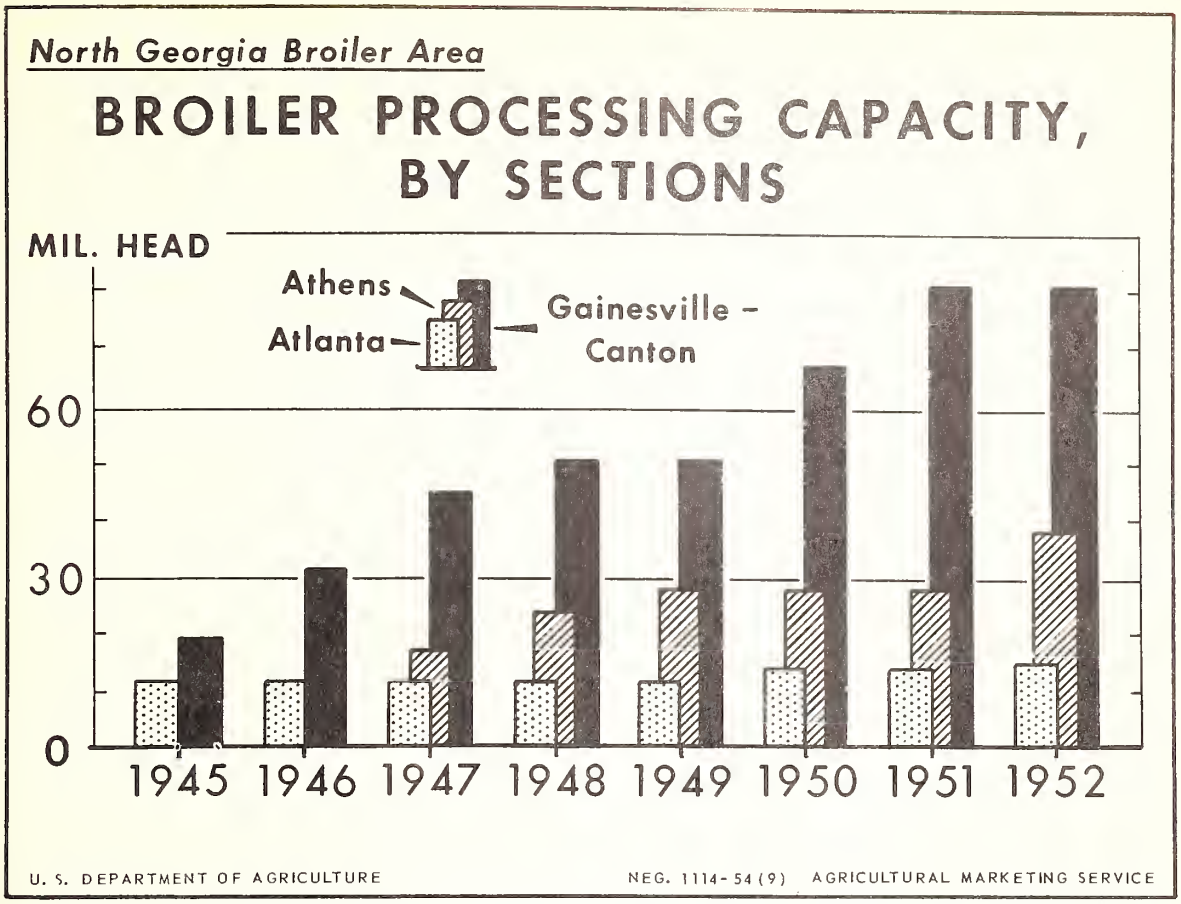


Figure 5.--Growth in annual broiler processing capacity, by sections, for the north Georgia broiler area, 1945-52.

Ten plants in the area had in-plant facilities for freezing a part of their output. Of these, 7 were located in the Gainesville-Canton section, 2 in the Atlanta section, and 1 in the Athens section. Only 2 of the 10 had adequate facilities for freezing all of their output.

In the area studied, 6 plants had facilities for feeding broilers at the plant, 5 of which were in the Gainesville-Canton section. Only 2 of these 6 fed all broilers coming into the plant, the other 4 fed enough broilers overnight to supply the processing line for 1 to 2 hours on the following morning. These were usually all processed by the time the first load of live broilers arrived from the farms.

Thirteen plants had trucks and coops for hauling some or all of their live broilers from the farms. All plants either owned or contracted for trucks for delivering the processed broilers to the buyers.

Location of Processing Facilities in Relation to Location of Producers

The distance between processing plants and the production point affects costs of procurement in at least three ways: (1) Shrinkage of the live broilers in transit from farm to plant, (2) truck and labor costs, and (3) communication between the processing plants and the farm. These are by no means the only cost variables of concern in the location of a plant, but they are important. The difficulty of communication encourages the maintenance of middlemen between the processors or other types of primary buyers, and producers. In 1951 feed dealers found buyers for practically 100 percent of the broilers produced, made price decisions, and received payment 2/. In many instances the feed dealers also hauled the live broilers to the processing plants.

This system has come about largely through the methods of financing producers, but partly because of the relatively small size of producing units. These units averaged approximately 3,000 broilers per farm every 12 to 14 weeks, or a quantity sufficient to keep a typical processing plant in north Georgia operating for 1 hour. In order to operate 40 hours per week over this period the manager of a plant processing 3,000 broilers per hour would have to maintain contact with more than 500 such producers. The complexities and costs of communicating personally with these would increase as their distance from the plants increased, and many do not have telephones.

In order to analyze the location of processing facilities in relation to the location of producers, the total production of broilers in the north Georgia area was allocated to three sections. This was done on the basis of estimates of annual placements of baby chicks obtained from feed dealers. These computations indicate that the Athens section has substantially less production than the processing capacity could handle (tables 3 and 4). In 1952, for example, the output of processed chickens exceeded the estimated production in the section by nearly 20 percent. In earlier years the excess was relatively much greater.

2/ O. C. Hester and W. W. Harper said in their report (footnote 1) on an earlier phase of this study: "One of the most readily apparent effects of the method of financing on marketing of broilers is the transfer of marketing services and decisions from the producer to the credit agency--the feed dealer. All of the dealers interviewed indicated that it was their responsibility to market the broilers grown by producers they supplied. This can be an advantage to the producer in that it relieves him of the necessity of contacting several buyers, bargaining, and collecting for the broilers after the sale has been made. The individual producer may not have the facilities or the time to contact the buyers intermittently when the broilers are ready to sell. The dealer with several producers marketing broilers each week can maintain daily contacts with processing plant buyers as well as live markets. Dealers with a large volume are also in a better bargaining position than the individual producer."

The output of processed poultry in the Atlanta section was about equal to estimated production in 1952. However, in earlier years processors in Atlanta found it necessary to go considerable distances for their supply of broilers. In the Gainesville-Canton section, production was about 9 percent larger than the processed output in 1952, but the ratio has varied considerably since 1945.

Table 3.- Processing facilities, production, and output of processed broilers, by sections, north Georgia, 1952

Area and section	Annual normal capacity	Estimated production	Surplus normal capacity	Processed output	Net transfer of broilers	
					In	Out
	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands
North Georgia						
Atlanta - - -	14,820	13,177	1,643	13,230	53	---
Athens 1/ - -	33,242	22,096	11,146	26,178	4,082	---
Gainesville-Canton - -	2/ 81,343	77,348	3,995	3/ 71,105	---	6,243
Total	129,405	112,621	16,784	110,513	---	4/ 2,108

1/ One plant operated only during the last quarter of 1952. If its annual capacity were included here, the total would be 38,234,000 head.

2/ Capacity of 5 plants estimated.

3/ Output of 6 plants estimated.

4/ An earlier phase of this study showed that about 20 percent of north Georgia's production of broilers in 1951 was shipped live to markets outside of the area. However, according to numerous individuals in the area, there were less out-shipments of live broilers by 1953.

As production was below processing capacity in the Athens section, processors there hauled live broilers over greater distances on the average than in any other section (table 5). A large part of the live broilers processed in the Athens section came from counties along the western fringe of the section. The remainder came from the area north and west of Forsyth and Hall Counties (fig. 6) 3/.

3/ For those who desire some estimate of the costs of assembling broilers the following bulletin is recommended: King, R. A., and Zwick, C. J., Competitive Position of the Connecticut Poultry Industry: 4. Shrinkage of Live Poultry Between Farm and Market, Conn. Agr. Expt. Sta. Bull. 270, October 1950, Storrs, Conn.

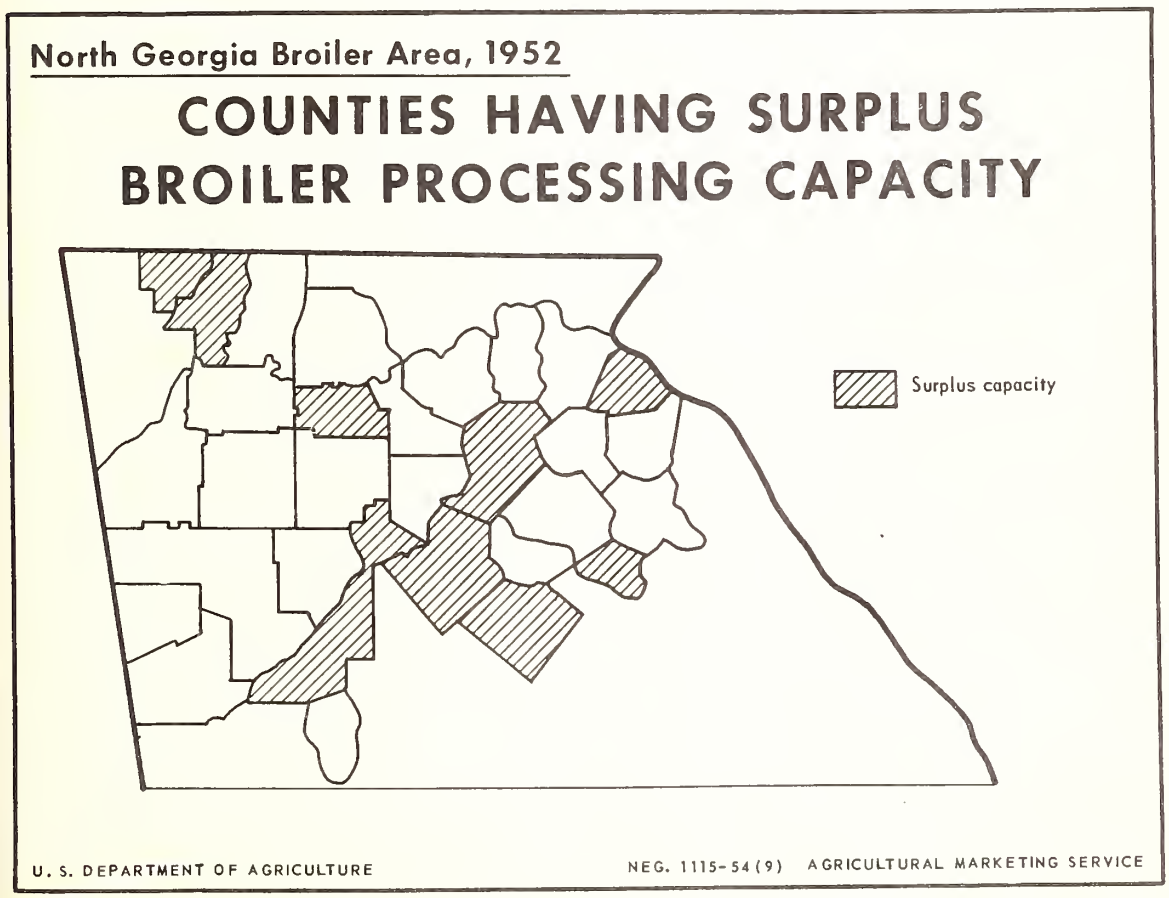
Table 4.- Broiler production and processing capacity, by sections, north Georgia, 1945-52

Year	North Georgia											
	Atlanta			Athens			Gainesville-Canton			Total		
	Production	Capacity		Production	Capacity		Production	Capacity		Production	Capacity	
		Normal	Maximum		Normal	Maximum		Normal	Maximum		Normal	Maximum
	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands
1945	3,662	11,648	13,520	854	---	---	24,735	19,840	20,758	29,251	31,488	34,278
1946	2,185	11,648	13,520	413	---	---	19,838	31,786	34,303	22,436	43,434	47,823
1947	3,185	11,648	13,520	709	17,680	17,680	24,823	44,943	47,568	28,717	74,271	78,768
1948	4,204	11,648	13,520	2,520	24,024	24,440	26,301	50,767	54,848	33,025	86,439	92,808
1949	6,512	11,648	13,520	6,234	27,934	28,350	32,827	50,767	54,848	45,573	90,349	96,718
1950	7,566	13,720	16,432	9,943	27,934	28,350	45,382	67,407	73,776	62,891	109,061	118,558
1951	9,630	13,720	16,432	16,867	27,934	28,350	62,181	81,343	89,792	88,678	122,997	134,574
1952	12,231	14,820	17,168	21,420	38,234	39,998	78,970	81,343	89,792	112,621	134,397	147,408

Table 5.- Distance live broilers were hauled to processing plants, by sections, north Georgia, 1952

Area and section	Miles hauled: Percentage distribution: Under 20	20-39.9	40 and over	Other 1/	Total	Average
	Percent	Percent	Percent	Percent	Percent	Miles
North Georgia						
Atlanta - - -	19	65	9	7	100	29
Athens - - - -	23	49	28	--	100	34
Gainesville-Canton 2/	60	22	8	10	100	19
Average - - -	46	34	13	7	100	24

1/ Classification different from those used in this table.
2/ Estimated for 5 plants.


North Georgia Broiler Area, 1952
COUNTIES HAVING SURPLUS BROILER PROCESSING CAPACITY
Surplus capacity
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NEG. 1115-54(9) AGRICULTURAL MARKETING SERVICE

Figure 6.--Location of surplus processing capacity, north Georgia broiler area, 1952

Variations in the Use of Processing Capacity

The question of surplus capacity in an agricultural processing industry cannot be answered by comparing annual processing capacity with annual production. This is especially true for a commodity that is highly seasonal in production and is perishable in the natural form. Economic conditions dictate a close relationship between age of the broiler and the time of its processing. An increase in the amount of feed consumed per pound of gain in the broiler occurs for each successive week that feeding takes place. The age at which the maximum profit could be obtained (or the least loss suffered) from broilers was roughly between 9 and 11 weeks. This is according to relationships that existed in 1952 between prices paid for feed and baby chicks and prices received for finished broilers in the north Georgia broiler area. Holding for longer periods than this resulted in lowered returns.

Broiler production varies seasonally and in addition there are definite swings in production due to price influences, availability of baby chicks, and so on, which at times greatly increase demands on processing facilities. Therefore, processing capacity in the area has to be sufficient to handle the output at the top of these cycles with hours of operation reasonable for single shifts.

The qualification of single shifts with reasonable overtime is inserted, because many of the operations in the processing plants require a great deal of skill. Also, the recent and rapid growth of the industry has not allowed for the training of a reserve pool of plant employees. In addition, enough supplies for double-shift operations have not been regularly available and the very intermittent work for another full crew probably would have been insufficient to hold them.

Double shifts with less hourly processing capacity might have proven more profitable. However, profits or prospective profits in this area were attractive enough to encourage the entry of enough processing firms to provide sufficient single-shift capacity.

To determine the cyclical or seasonal utilization of processing capacity during 1952, estimates by the former Bureau of Agricultural Economics of weekly chick placements in north Georgia between the third week in October 1951, and the third week in October 1952, were adjusted to actual production in 1952 and compared with weekly normal capacity. Under certain conditions some farmers may hold broilers on the farm for more than 11 weeks. However, the economics of broiler production strongly supports the theory that there is a firm direct relationship between placements and marketing 10 or 11 weeks later. This comparison (assuming no transfer of live broilers into or out of the area) shows that in April, May, and June 1952, 100 percent or more of the single-shift capacity was utilized. In July, August, and September, 90 to 99.9 percent was utilized, and in the first and last quarters of the year, 75 to 85 percent was utilized.

The highest utilization occurred in the month of May when 111 percent of normal monthly capacity would have been required to process the total production (fig. 7). A similar comparison for the three sections (assuming uniform seasonality in production throughout the area) indicates that the Athens section was the only one which did not have more production of broilers than capacity for processing them during some periods.

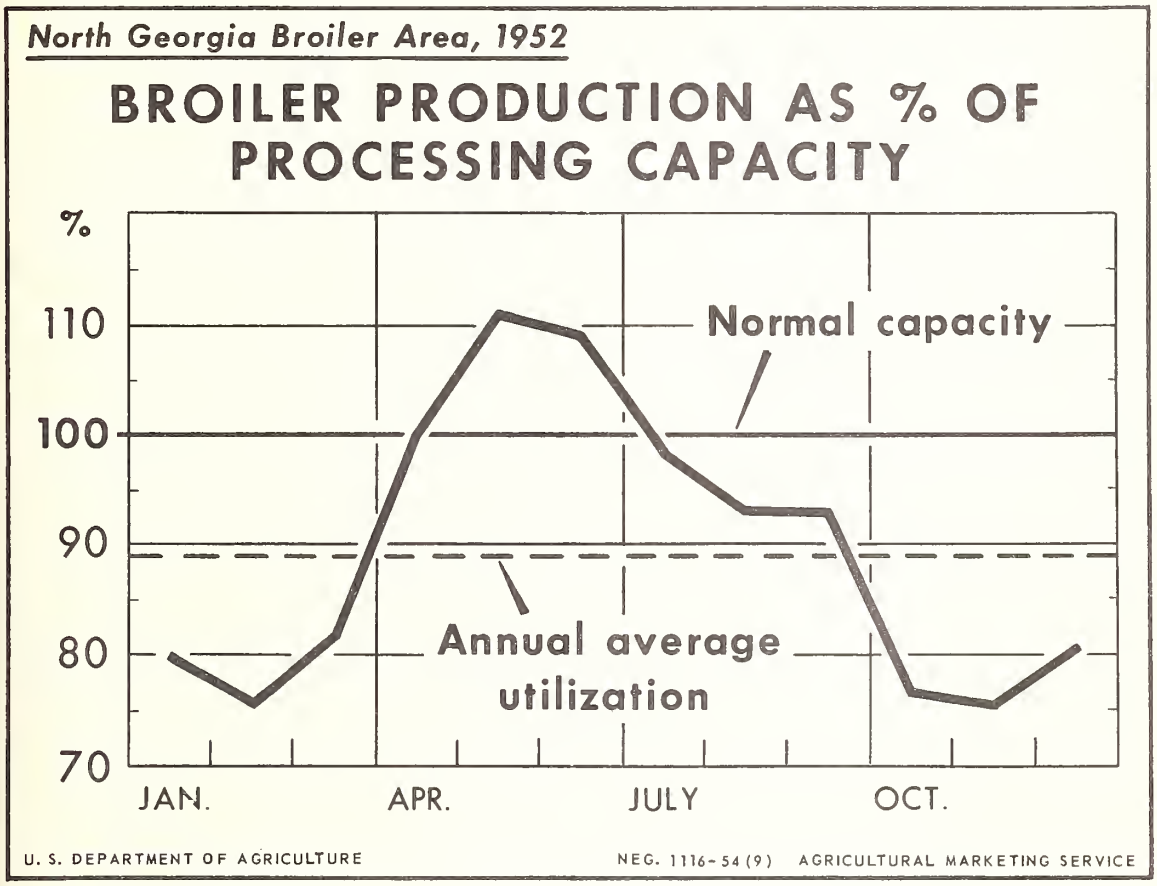

Figure 7.--Estimated broiler production compared with broiler processing capacity, by months, north Georgia broiler area, 1952.

Broiler processing capacity in north Georgia in February 1953 was approximately 2.8 million head per week of 40 hours' operation. Sixty-five percent of this capacity was accounted for by plants that normally processed 2,750 or more birds per hour. If these large plants had operated two daily shifts during 1952, their capacity would have been much more than sufficient to process the peak production. This was true of much of the period 1945-51 also.

It seems, then, that the industry can substantially expand its capacity by working extra shifts. But, installation of processing facilities has not

ceased. A new plant began operating in the spring of 1953, and at least two new plants, replacing older ones, started in the summer of 1953. In view of the opportunity for expanding capacity by working extra shifts, careful study should be given to prospects for adequate supplies before additional facilities are built. This suggestion should be particularly heeded by newcomers having no prearranged sources of supply.

ASSEMBLING PRACTICES, TYPE OF PRODUCT, AND MARKET OUTLETS

Assembling Practices

Some differences in practices among the broiler processors seemed to be associated with the location of the plants; others with the scale of operations. Some of these practices affected the costs to processors considerably, although their effects cannot be precisely measured.

In at least one instance in each section the processor financed and furnished feed for, or in other ways exercised control over, many of the broilers he processed. Such integration allows for a rather rigorous scheduling of placements with producers to meet the needs of the processor. The processor can enter into advance contracts for delivery of dressed broilers of certain weights, and thus reduce the cost of arranging for broiler supplies. A close alliance between the independent feed dealer and the processor, however, can produce the same results.

Dependence on the open market for predetermined quantities of particular weights is rather hazardous and expensive. The reason is that the producer who is growing broilers for his own account must take into consideration the cost of feed and baby chicks, and the price being paid for finished broilers before deciding at what weight to market the birds. Uncertainty of action may cause delays which add to the expense of procurement. Premium prices for particular weights could influence the producer (or independent feed dealer) to give the processor the weights desired. Only one processor in the north Georgia broiler area reported paying any regular premium for certain weights. Others may have offered such premiums over short periods.

Assembling large lots of commercially grown broilers for processing is much more efficient than is the assembling of poultry from small farm flocks, but the cost is still sizable. Loss resulting from shrinkage of the live broilers between farm and plant and truck and labor costs must be included in the farm-to-retail price spread. For plants having low rates of output and no room available for feeding, considerable shrinkage occurs between the time the birds are delivered to the plant and the time they are killed. This shrinkage has to be considered as an assembling cost as it could be eliminated only by small deliveries at frequent intervals. Either alternative is expensive 4/.

4/ For a thorough discussion of hauling shrinkages see, Eastwood, Ralph A. and Scanlan, John J., Operating Costs of 15 Cooperative Poultry Dressing Plants. Farm Credit Administration Bull. 70, June 1952, Washington, D. C., pp. 25-28. Also see the bulletin referred to in footnote 3.

Table 6 summarizes the statements of 21 processors concerning procurement practices. Processors in the Gainesville-Canton section provided assembling services only when they financed a part of the production they used. In other instances the feed dealer made delivery. Of the 3 processors in the Gainesville-Canton section who financed production, 2 accepted farm weights as a basis of settlement. One paid one-half cent a pound premium for birds delivered to the plant door. All others paid on the basis of the weight delivered to the plant door by the feed dealer, with no reported premiums.

Table 6.- Percentage distribution of source of supply of live broilers, basis of price settlement, and assembling practices of 21 broiler-processing plants, by sections, north Georgia, 1952

Practice	North Georgia			
	Atlanta	Athens	Gainesville-Canton	Average
	Percent	Percent	Percent	Percent
Source of supply:				
Own operation	32	3	32	25
Independent feed dealers	68	97	68	75
Total	100	100	100	100
Agency hauling live birds:				
Plant				
Own trucks	37	77	49	54
Hired trucks	1	16	---	4
Feed dealer	49	5	51	40
Producer	13	2	---	2
Total	100	100	100	100
Basis of price settlement:				
Plant weight	25	7	70	49
Farm weight	75	93	30	51
Total	100	100	100	100

The opposite situation was true in the Athens section where processors did the assembling and paid on a farm-weight basis; and this practice prevailed to some extent in the Atlanta section. All processors in the Athens section either did their own hauling or paid a premium for delivery. In the Atlanta and Athens sections three processors paid a premium for delivery even though they used farm weights as a basis of settlement.

Some adjustment in price to take care of assembly costs was apparently made, because prices were reported at two levels for the area. One was for broilers picked up and weighed at the farm by the processor, and the other was for broilers delivered to the plant by the feed dealer (or producer). The range in prices reported at each level allows for some adjustment for assembly costs without exceeding the limits of the range 5/.

Another limiting factor in attempting to distinguish differences in competition for supplies between processors is the actual use of the reported prices. Some producers, feed dealers, and a few processors stated that the reported prices were applicable only during periods of stable prices. As the prices for broilers rose, those processors who had little control over their supply found that they had to pay above the reported prices. The reverse was true as the market weakened; a number of dealers who had no steady outlets reported that they accepted less than the reported prices for the broilers.

Another practice that affected costs in processing plants in the Gainesville-Canton section was that of feeding live broilers after they arrived at the plant. Four plants in this section fed overnight from 10 to 35 percent of the birds needed daily in order to have birds for early morning operations. Of the 2 plants that fed for weight gain, 1 held all receipts for 24 hours, and another for 36 hours. One plant in the Atlanta section fed some birds overnight.

Type of Product, Outlet, and Market Area

Marketing poultry on a "ready-to-cook" basis has shown an upward trend. This trend has been particularly pronounced in southern commercial broiler areas, with the result that practically all plants in the South eviscerate poultry. Three reasons for this, in addition to market demand for such a product, are: (1) Rapid yet continuous expansion of production in areas where little poultry production existed before, required the installation of processing facilities and encouraged investments in modern plants and machinery; (2) concentration of production in small areas permitted the efficient use of byproducts from evisceration; and (3) the long distances to major markets necessitated the scaling down of transportation costs.

Probably the third reason is more pertinent to the north Georgia situation than are the other two. For example, Georgia broilers are marketed to a great extent in distant cities, and practically all movements are by truck. A ton of eviscerated poultry contains roughly one-fourth more edible meat than a ton of New York dressed poultry. Load maximums allowed by States through which the trucks must pass seem to be the limiting factor on the number of pounds hauled per load.

5/ For a further discussion of this situation, see the reference in footnote 1. The section headed, "Marketing Live Broilers," is particularly pertinent to this situation. As the survey of feed dealers covered only a sample of all such dealers, it is impossible to correlate the suppliers with the buyers in such a manner as to answer the questions raised here.

None of the commercial broiler-processing plants in north Georgia sold any New York dressed broilers in 1952. Ready-to-cook, whole, ice-packed broilers accounted for 77 percent of the 1952 output (table 7). Ninety-eight percent of the cut-up broilers were frozen. Some processors mentioned a growing demand from retailers for a fresh, tray-packed, cut-up product. However, the shelf life of such a product apparently is less than for the whole bird when ice-packed. And the present limitations of distance and rehandling on the rapidity of movement to major out-of-State markets prevent plant operations from processing the product to this degree.

Table 7.- Type of processing performed by broiler-processing plants, by sections, north Georgia, 1952

Item	Ready-to-cook		
	Whole	Cut-up	Total
	Percent	Percent	Percent
North Georgia			
Atlanta	99	1	100
Athens	100	1/	100
Gainesville-Canton	74	26	100
Average	83	17	100
Percentage frozen	6	98	22

1/ Less than 0.5 percent.

In most of the north Georgia area in 1952, wholesale receivers were the major buyers of broilers from processors (table 8). In the Atlanta section,

Table 8.- Sale of broilers by type of outlet used by broiler processors, by sections, north Georgia, 1952

Area and section	Type of outlet			Total
	Stores and restaurants	Wholesalers 1/	Chain stores	
	Percent	Percent	Percent	Percent
North Georgia				
Atlanta	59	5	36	100
Athens	7	78	15	100
Gainesville-Canton	8	77	15	100
Average	14	68	18	100

1/ Including sales to the Armed Forces.

stores and restaurants in local markets were the main outlets serviced by both small and large processing plants, and they were the main outlets for small plants in the other sections. The cut-up broilers were marketed to local chain and retail stores, jobbers, and hotel suppliers to a greater extent than were the whole birds. Processors in the Atlanta section sold practically all of their output in the local area--Atlanta, Macon, and Rome, but processors in the other sections sold primarily to outlets in the North Central States (table 9).

Table 9.- Percentage distribution of market areas used by broiler processors, by sections, north Georgia, 1952

Market area	North Georgia			
	Atlanta	Athens	Gainesville-Canton	Average
	Percent	Percent	Percent	Percent
Southern area				
Georgia	95	13	7	19
Florida	---	3	15	11
Gulf States	5	---	7	5
Total	100	1/ 37	1/ 32	1/ 42
North Central States	---	63	55	50
Western States	---	---	2	1
Other 2/	---	---	11	7
Grand total	100	100	100	100

1/ Includes marketings by processors stating only that their marketings were in "Georgia, Florida, and the Gulf States."

2/ Some processors did not state markets specifically enough to permit weighting.

For the area as a whole the North Central States bought 50 percent of the output; Georgia, 19 percent; Florida, 11 percent; and other Gulf States, 5 percent (marketings to each area could not be estimated by some processors). Some poultry was shipped from the Gainesville-Canton section to California, but the reported quantity was only 1 percent of 1952 marketings.

Until recently there were only a few commercial broiler areas in the United States. Maine, Shenandoah Valley, North Carolina, South Carolina, Florida, Alabama, Louisiana, Mississippi, Texas, Missouri Kentucky, Indiana, Wisconsin, central California, southern California, Washington, and possibly others have begun to produce broilers commercially. Some of these broiler-producing areas have begun to compete with north Georgia for southern markets, particularly for the markets of Florida and the other Gulf States and will

probably continue to do so. Also, the increase in production in the Northeast, which area competes with Del-Mar-Va, has led to competition from Del-Mar-Va with north Georgia, Arkansas and local areas for markets in the North Central States.

Yields

One of the most important factors affecting the costs of the processor is the yield of processed broilers from his purchases of live birds. This yield is the weight remaining after losses due to continued metabolism of the live bird; the removal of blood, feathers, head, feet, oil gland, and inedible viscera; and the grading out of a few unsalable carcasses. The processor who is successful in reducing this "cost" is usually the processor who is most successful in meeting competition, and the methods by which relatively large yields are obtained are carefully guarded.

Shrinkage in the live bird is related to the length of time the bird is held off feed and water, the activity of the bird, and temperature and relative humidity. Under the commercial conditions in north Georgia, differences among plants are minor. The producer knows beforehand at what time the birds will be picked up, within the range of an hour or so, and he can feed the birds up to a few hours before they are picked up. Water is available to them until loaded. The loading operation on the farm takes about an hour and the drive to the plant less than an hour on the average. Unless the birds are to be fed, the killing operation begins within 30 minutes after this arrival at the plant. The average load of 3,000 broilers moves through the killing station of the typical plant (3,000 birds an hour) in 60 minutes.

As was pointed out earlier, a number of processors pay for birds on the basis of weight delivered at the plant door. In such cases, the processor does not have to contend with evaporation of moisture during transit. In any event, this shrinkage should not amount to more than 5 percent and usually is less than 3 percent 6/. In addition, the practice of cooling the processed birds in iced water replaces some of the moisture lost through evaporation.

The factors affecting yield other than loss of weight are relatively inflexible. Bruises and tears may be reduced by careful handling of the birds. Intensive culling of the birds on the farm can eliminate the costs to the processor of the unsalable birds and the costs of processing them.

No attempt was made to determine the practices followed by processors in the north Georgia broiler area to control yield. They were asked to estimate their yields for 1952. The average yield of eviscerated broilers in this area for the processing plants having feeding stations was 72.4 percent of weight purchased and ranged from 67 percent for a small plant to 75 percent for a large one. Yields in plants without feeding stations

6/ See reference cited in footnote 4.

averaged 72.8 percent with a range of from 70 to 74 percent. In general, the explanation for the lower yield in plants feeding broilers lay in the relative size of plants feeding as compared to those not feeding, as size of plant was related to the yield.

In those plants without feeding stations the average yield for plants killing less than 1,000 broilers per hour was 72.5 percent; 1,000 to 1,999 per hour, 73.1 percent; 2,000 to 2,999, 74.0; and 3,000 or more killed per hour, 72.4. Of the 4 plants operating at 3,000 or more birds per hour, 2 hauled part of their live supplies 100 miles or more and accepted farm weights as the original weight. Yield of cut-up broilers averaged 71 percent.

Yield has two important effects on the net profits or losses of the processor. First, average labor and overhead costs on an eviscerated weight basis are increased all down the line as yield decreases. Second, raw-material costs are relatively greater with low yields. Suppose, for example, that 3-pound live broilers, purchased for 28 cents per pound, yield 2.25 pounds of eviscerated product in Plant A and 2.15 pounds in Plant B. It can be seen that the cost per pound of eviscerated product will amount to 37.3 cents for Plant A and 39.1 cents for Plant B. A cost of processing of 20 cents per bird will push the price per pound of eviscerated broiler to 46.2 cents for Plant A and 48.4 cents for Plant B.

USE OF LABOR AND MACHINERY IN PROCESSING BROILERS IN NORTH GEORGIA

The guiding principles in practically all processing of farm products, as well as other industries, have been (1) substitution of machinery for labor, and (2) work simplification and specialization. The successful application of these two principles to poultry processing shows up well in the following description of typical layouts and operations in large broiler-processing plants in north Georgia.

Layouts and operations of broiler processing plants in north Georgia were technically different from plant to plant. Each manager relied on his own and his plant foreman's ingenuity to process broilers as efficiently as possible with the machinery and floor space available. However, because there was more uniformity among the larger plants in the area than among the smaller plants, it was possible to prepare a layout and describe a crew organization typical of the larger plants in north Georgia in the spring of 1953.

According to the plant managers the maximum rate of production per line on the lines with large outputs was from 3,500 to 4,000 birds per hour. But, many of these plants had limiting factors that would make such rates extremely hard to maintain except under favorable conditions. Some of these factors are: Length of scalders, number and kinds of machines, and lack of floor space for additional workers. However, many plants could achieve these rates by correcting one or two defects in the layouts. For this reason it was decided to take the layouts observed in the area, correct the obvious limitations, and present a plant that would typify large plants in the area.

At least 1 acre of land is needed for plants of the size illustrated in figures 8 and 13. The site should be well drained, convenient to a highway, and close to a power supply. Sewage disposal is important, although plans for the newer plants provide for the mechanical elimination from the plant of byproducts, such as feathers, blood, and inedible offal. Therefore, only the effluent part of the sewage, which in this case is considerable, need be considered.

The construction of the building need not be elaborate; in most cases the whole operation from receiving to shipping can be located on one floor for efficient use of labor and supervision. Concrete block buildings, used extensively, should be treated to provide nonporous walls that can be washed down and scrubbed. The floor in all cases should be of nonporous construction, usually of concrete, and having ample slope to drain. The amount of floor space should be governed by the number of employees and machines needed to do the required processing.

If the plant is to operate under the supervision of the Federal Inspection Service, the space allowances for specific operations and type of equipment used must meet the requirements of the Service. The layout illustrated in figure 8, which is typical for the larger nonfederally inspected plants, has sufficient area for the processing of 3,600 to 4,000 birds per hour. The number of employees performing each operation, assuming an hourly output of 3,600 birds, is shown in figure 8. The speed of the conveyor line is 1,800 feet per hour, and the shackles are spaced 6 inches apart.

In north Georgia it is the usual practice to dress the broilers as soon as possible after receipt at the plants. Evisceration on the same line is followed by cooling in slush ice, ice packing in wooden boxes, and loading on refrigerated trucks. This is generally called the straight-through operation. Thus, the plant illustrated in figure 8 provides no facilities for holding, feeding, or mechanical refrigeration. Most plants in other areas provide for feeding; in many cases, chilling prior to eviscerating; and mechanical refrigeration of the processed birds.

The trucks, loaded with coops of live birds, back up to (or pull alongside) the unloading dock (see cover picture). Usually employees on the trucks set the coops onto the platform or scales. Although most small plants in the area did not weigh the live birds at the plant, most of the larger plants did so. The coops are placed on the roller conveyor by an employee (1) 7/ and positioned so that employees can hang the birds by their feet in shackles on the overhead conveyor line (2). When emptied, the coops are taken by an employee (1) and weighed and stacked for loading on the truck. Floor area for holding coops is sufficient only for a few truckloads.

With a line speed of 1,800 feet per hour, a bird moves one foot every two seconds. As the time necessary to accomplish thorough bleeding varies according to breed and condition of the birds, some flexibility in the distance of the killers (3) from the scalding tank is usually provided for. Approximately 60 feet of conveyor line is shown in figure 8 for hanging, killing, and bleeding.

7/ The figures in parentheses refer to the numbers assigned to the workers.

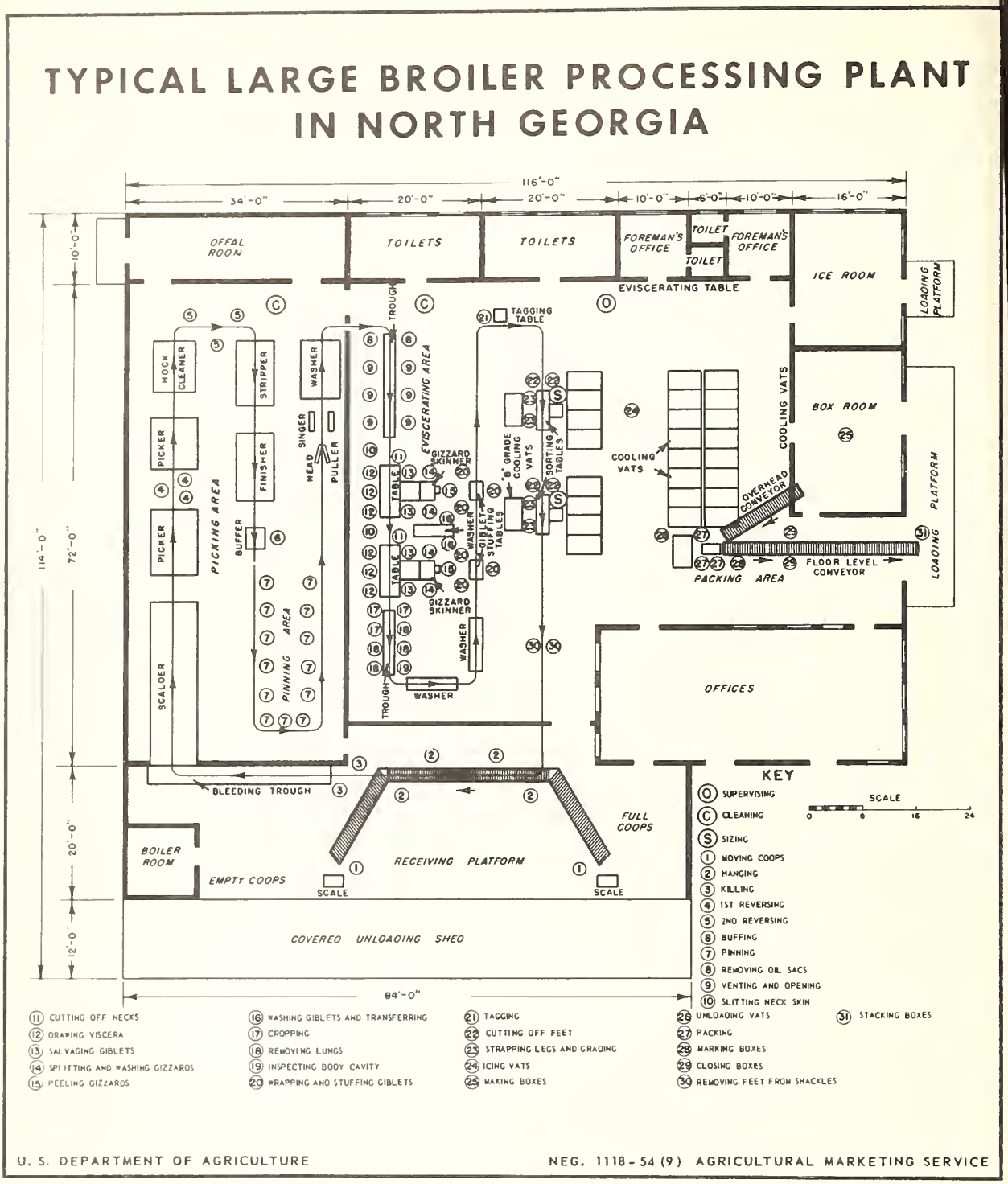

Figure 8.--Layout, labor assignments, and machinery typical of large broiler-processing plants using the straight-through operation, nonfederally inspected, north Georgia broiler area, spring 1953.

The birds pass over the bleeding trough and into the scalder. Water constantly flows into the scalder to replace that taken up by the feathers and to cause an overflow which serves to float off feathers and other material. Scalders can be obtained in various lengths depending upon the desired speed of the line and the type of scald. The one illustrated in figure 8 is for slack scalding (126° to 128° F.) and allows for the birds being in the scalders 48 seconds. However, the length of the scalder can be increased by the addition of extra sections, thereby increasing the scalding time with no change in line speed.

From the scalder the birds pass through an 8-foot automatic picker. These machines have two drums with attached rubber fingers which revolve in opposite directions so as to pull the feathers from the body of the bird in a downward motion.

When the birds come out of the first picker, workers (4) remove them from the shackles and rehang them by the neck (fig. 9). The birds then proceed to the second mechanical picker where additional scrubbing with rubber

Figure 9.--Reversing birds from the feet hold in the shackles to the head hold.

fingers is done. Some manufacturers make what is generally called a reverse picker, which eliminates the necessity of turning the bird by hand. The head of the bird is gripped by a track conveyor adjusted to the speed of the overhead conveyor and rubber fingers attached to the drums of the machine turn so as to remove feathers with an upward motion.

By hand turning, birds are again reversed (5) (hung by their feet) and pass through additional mechanical pickers which are adjusted to remove the feathers in the neck and wing regions. The birds are next conveyed through a picker equipped with short stiff rubber fingers which are directed at the legs of the bird, and the feathers around the legs and hocks are removed. When a reverse picker is used, this operation is often performed by vertically moving brushes which scrub the hocks passing between them.

Approximately 100 feet of conveyor line is needed for the picking machinery. The machines are located close together on the line with the exception of the space left at the two reversing stations. In the layout shown, the length of the machine and the speed of the conveyor line provide that every bird will be in each picking and finishing machine for 16 seconds. Most lines had at least one picking machine that required a worker to manipulate the birds against the revolving fingers. On the line pictured, such manual buffing should be required for only the more difficult birds, such as "barebacks," and one worker should be able to handle this operation (6).

Constant removal of water from the scalders and washers and feathers from the picking area is necessary. Floor drains slope away from the scalder toward the offal room or some other disposal area, and the feathers are moved either manually or by conveyor in that direction for later disposal. On most lines employees are assigned to cleanup operations concurrent with processing. On others, thorough cleanup operations are carried on by certain employees during the rest periods.

Approximately 90 feet of line is shown for pinning (7). This much space is needed only for the birds most difficult to pin, and will ordinarily appear to be unused space. However, the cost of this space as compared to less space seems justified when compared with the loss of labor on the remainder of the line caused by removing unfinished birds from the shackles at the end of the shorter pinning line. Another advantage of this amount of space is that the pinners can fall behind to some extent before the foreman has to assign extra workers to the pinning line.

In pinning, workers usually take a single bird on the line, walk along with it, and complete the job of pinning before turning back to start on another bird. By working close to the bend in the line, the workers eliminate some of the walking in returning to their starting point. The number of persons necessary depends upon the temperature of the scalding water, breed and condition of the birds, the number and adjustment of the machines being used, and the thoroughness of the pinning and cleaning jobs demanded by the buyers.

Except in plants under Federal supervision, a rigid head-pulling device is usually located on the line after the pinning area. The birds next pass between two gas-fired burners for singeing and into a washer, which is equipped with sprays and long rubber fingers that are attached to revolving drums, in which the birds are washed before they go to the eviscerating room.

After passing into the eviscerating room the birds move over a stainless steel trough where the oil sac is removed (8), the bird is vented and opened (9). This trough should be long enough to permit eight people to perform these operations at the stated speed of the line.

The birds next travel toward a T-shaped table where the viscera are drawn (11) and the giblets separated from the intestines (fig. 10). Because of the number of people required, these tasks are divided between two groups of workers at two tables as shown in figure 8. Each group has identical duties. Many of the operations in the eviscerating process are duplicated by either two or four people. For this reason the shackles are sometimes marked with four different colors. The birds hanging on the shackles of a

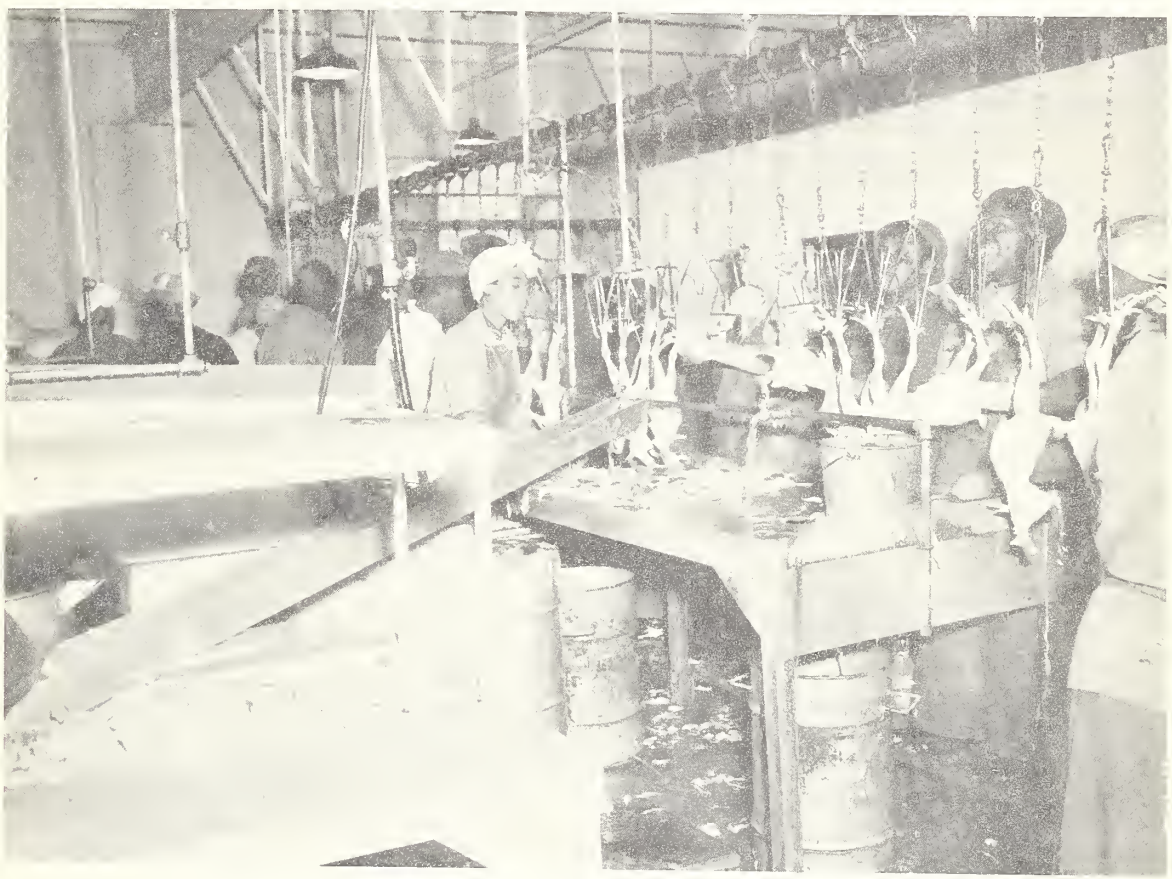

Figure 10.--Eviscerating table and giblet trough used on several nonfederally inspected lines in broiler processing plants in north Georgia.

certain color are assigned to a specific worker to avoid confusion in processing all birds and to help the inspectors in checking the performance of individual operators. Just before the birds reach the T-table 2 workers (10) slit the neck skin for ease in cropping and 2 other workers cut off the necks (11). The viscera are pulled and dumped (12) onto the T-table which is constantly flushed by a spray of water, and the giblets are separated (13) from the other viscera. The intestines are then pushed through an opening into a container for disposal.

The birds next pass over another stainless steel trough where cropping (17) is performed. Inspection of the body cavity (19) and removal of small internal organs are also performed at this point.

The line next passes through two washers, one of which sprays water on the outside of the bird and is sometimes equipped with long revolving rubber fingers. The other washer usually consists of tanks of running water through which the birds are pulled by the conveyor chain. The second or internal washing is sometimes done manually by directing a stream of water into the body cavity.

The giblets are salvaged (13) and washed under a spray at the T-shaped table, and the gizzards are opened, cleaned (14), skinned (15) and passed through a revolving spray-type washer. All the giblets and the neck are collected (16) at a central wrapping station. Here they are enclosed in a wax wrapper and stuffed (20) into the body cavity of the bird as it comes down the line from the washers.

The birds are generally removed from the lines by severing the feet (22) at the hock joint. They are placed on a table where the hock joints are thrust through the abdominal strap (23), and scale operators (S) place them in iced vats according to weight (fig. 11). These vats are removed when full and hooked to an air hose (24) which forces air through the slush ice from the bottom to accelerate the cooling process and to maintain a constant temperature throughout the vats.

After about an hour the cooling vats are moved up to a box conveyor where the birds are removed (26), packed in boxes (27), and the net weights of the boxes recorded (28). The birds are then covered with ice and the boxes are closed and placed in trucks (29) for distribution (fig. 12).

All plants in north Georgia of the size illustrated in figure 8 had extra employees available for relieving other employees who were performing difficult operations or where the operations required the employee to work at a rapid rate. These "floaters" were also available for helping on any operation in emergency. Most plants also stopped the lines occasionally for rest periods, particularly if the line was operating at a rate that caused a number of employees to work near the upper limits of their abilities. In most smaller plants the fatigue problem was solved by intermittently rotating employees from difficult or fast operations to simpler or slower ones.

Figure 11.--Manual sorting of broilers by weight.

Figure 12.--Weighing, icing, and closing boxes of broilers.

For this straight-through operation approximately 10,000 feet of floor space is needed. The machinery including conveyor equipment represents an investment of 25 to 35 thousand dollars. Output could appraooh 38 broilers per man-hour with well-trained and efficient workers.

If a plant is to operate under the supervision of the Federal Poultry Inspection Service, certain requirements must be met 8/. The requirements change from time to time as new techniques become known and as new machinery becomes available. The primary requirement is that the plant be so constructed that processing operations can be performed in a sanitary manner. Another is that the conveyors be operated at suoh speeds as will permit a sanitary eviscerating operation and an adequate inspeotion for condition and wholesomeness. Partioular details of plant oonstruction, equipment layout, and methods of handling the birds may vary some so long as these general requirements are met.

Those plants in north Georgia typified in figure 8 could, with certain exceptions, be remodeled for federally supervised operations. The following steps in this process are essential to proteot the plant owner against costly mistakes:

1. Apply to the Federal Poultry Inspection Service for inspection services. The Service will make a preliminary inspeotion of the plant and will suggest needed improvements in layout or facilities and methods. Any plant wholly unsuited in construotion features for federally supervised operations will be rejected, thus forestalling fruitless remodeling of facilities in such a plant.

2. Detailed blueprints and specifications of remodeling should be presented to the Service for approval before actually remodeling.

3. Final inspection and approval of the remodeled plant by the Service is then necessary before federally supervised operations oan begin.

In attempting to devise a means of remodeling the typical layout shown in figure 8 for federally supervised operations, it was assumed that the plant owner would be interested in using essentially the same space, facilities, and methods as before with a minimum decrease in hourly output of the plant. This oan be accomplished by revising the layout of the evisoerating and packing room of the plant as illustrated in figure 13. The average output probably oould not exceed 2,400 birds per hour.

8/ See "Regulations Governing the Grading and Inspection of Poultry and Edible Produots Thereof and United States Classes, Standards, and Grades with Respeot Thereto," reprinted from the Federal Register of June 5, 1951, and April 24, 1952. Copies of the latest regulations may be obtained by writing to the Federal Poultry Inspection Service, Poultry Division, Agrioultural Marketing Service, United States Department of Agrioulture, Washington 25, D. C.

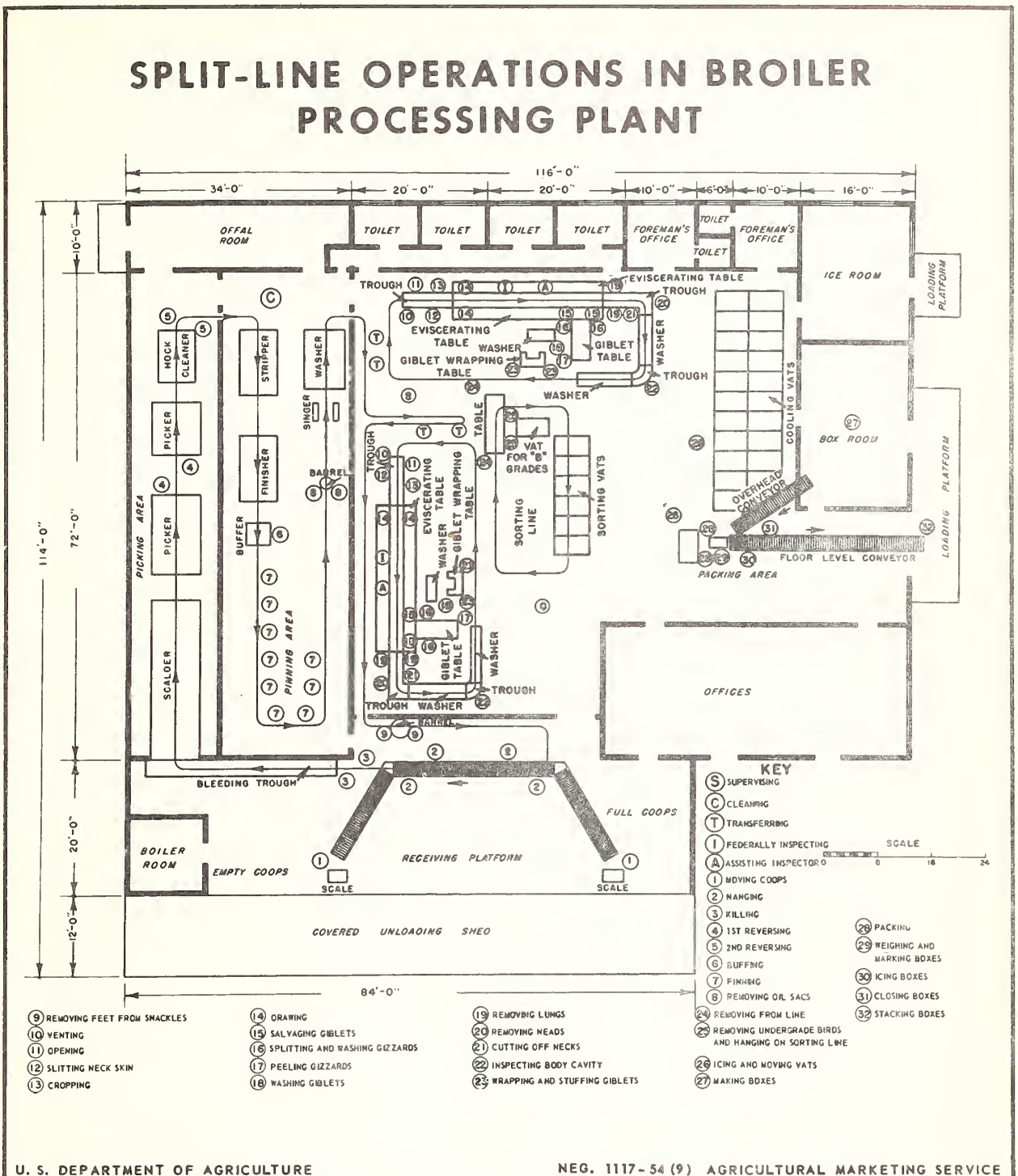

Figure 13.--Layout showing labor assignments and machinery in large broiler-processing plants having federally supervised operations.

Receiving, hanging, killing, scalding, and picking operations as illustrated in figure 13 are essentially the same as those shown in figure 8. However, shackle spacings would be changed slightly in order to allow the birds the appropriate amount of time in the scalding tank and in each piece of machinery. When the birds pass into the eviscerating room, they are removed from the dressing line by severing at the hock joints. They are hung on the two eviscerating lines by wings or hock joints. The distance between shackles on these lines is usually 12 inches, and the speed is controlled so that each line takes care of half the birds from the dressing line.

The operations on the eviscerating line are similar to those performed on the line shown in figure 8 except for the handling of the viscera. When the birds reach the eviscerating table area, the viscera are partially drawn over a moving belt synchronized with the overhead conveyor (fig. 14). This permits the inspector to examine viscera and carcasses simultaneously. Giblets are separated and cleaned following inspection, and the intestines fall into containers for disposal. The remaining operations illustrated in figure 13 are generally the same as those shown in figure 8 until the birds are removed from the lines. In figure 8 provision is made for manual sorting of the birds by weight and in figure 13 for mechanical sorting (fig. 15). Both practices are extensively used in north Georgia. From either weighing station the birds are cooled and ice-packed.

Variations in Machinery Use

Estimates of the time required for processing a bird in specified pieces of automatic or semiautomatic machinery indicate a very wide range. This variation applies both to individual machines and to the dressing line as a whole. Undoubtedly, much of this variation was caused by differences in the type of machinery used and by the fact that the machines were built in certain lengths only. It is to be supposed that there is an optimum period of time during which a broiler should remain in each machine and that this time will vary with such factors as scalding temperatures, age of birds, and so on. The rapid inspection of the processing plants made in this study did not permit an adequate analysis of these factors.

Four out of nine of the smaller lines processing 2,000 birds or less per hour used automatic machinery for reverse roughing, thereby eliminating the need for manually changing from the feet hold in the shackles to the neck hold. Only 1 out of 10 lines operating at more than 2,000 birds per hour used these roughers, however. Other differences in types of machines were in the use of buffers or sideline finishers. Only 11 plants out of 19 nonfederally inspected plants used buffers or sideline finishers.

The time that birds remained in various roughing machines varied between lines from 13.6 to 30 seconds (table 10). The time the birds are in these machines can be increased by slowing down the line or by adding more machines. The finishing machines were used in various ways, some for hock finishing,

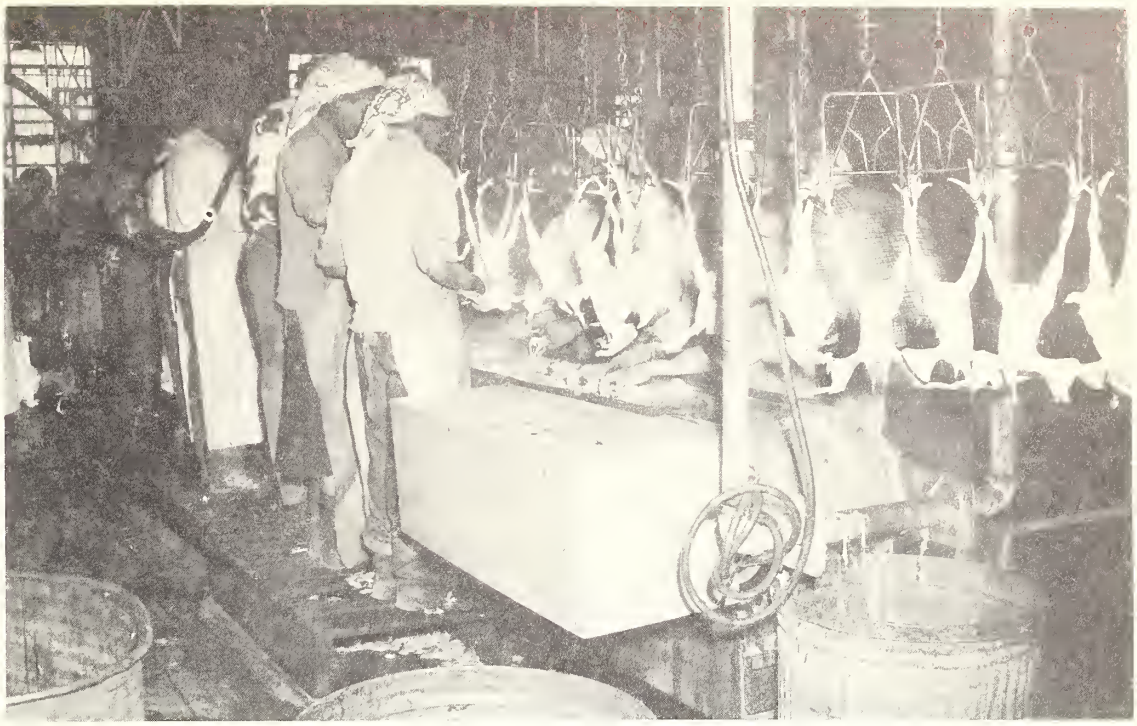

Figure 14.--View of conveyor belt for viscera showing the dumping of the intestines into a refuse barrel.

Figure 15.--Mechanical sorting of broilers by weight.

Table 10.- Number of lines and estimated machine-processing time per bird, by type of automatic and semiautomatic machinery on nonfederally inspected lines, north Georgia, spring 1953

Type of machine	Lines	Machine-processing time per bird	
		Average	Range
	Number	Seconds	Seconds
Rougher	19	18.0	13.6 - 30.0
Second rougher 1/	17	15.6	12.0 - 24.8
Buffer	6	2.2	1.8 - 3.1
Finishers			
Hock	14	15.7	6.8 - 29.9
Sideline	6	6.4	2.0 - 12.0
Wing	17	15.8	9.2 - 24.0
Body	2	13.8	13.2 - 14.4
Total or average	19		30.0 - 90.0

1/ Two lines operating at slow speeds did not use the second rougher.

some for wing finishing or neck finishing. Birds processed on lines having buffers and sideline finishers spent less time in automatic machines than on lines having only automatic machines (table 11). No measures of relationship between the types or combination of types of machines and labor requirements for pinning could be developed from the data obtained, however.

Table 11.- Estimated machine-processing time per bird by specified combinations of automatic and semiautomatic machines, on nonfederally inspected lines, north Georgia, spring 1953

Type of machine	Machine-processing time per bird			
	Manual and automatic 1/		All automatic 2/	
	Average	Range	Average	Range
	Seconds	Seconds	Seconds	Seconds
Body	32.1	22.4 - 49.6	36.6	27.2 - 52.2
Leg, wing, or neck	24.3	0 - 48.0	30.6	17.0 - 48.3
Manual	4.5	1.8 - 12.0	---	---
All types	60.9	30.0 - 90.0	67.2	44.2 - 85.1

1/ 11 lines.
2/ 8 lines.

The estimated average time that each bird on fully automatic lines remained in the two major types of machines was: Roughers and body finishers, 36.6 seconds, and hock, garter, and wing finishers, 30.6 seconds. The variation from these averages was wide.

Variations in Labor Use

The variation in the output per worker was somewhat less than was the variation in "machine minutes." The number of workers can be adjusted from day to day by relatively small changes; that is, 1 person may be added or subtracted from 100 workers as the need becomes apparent without materially affecting output per worker. There was not complete flexibility in labor requirements of the lines observed, however, because of the assignment of a specific operation to a single employee.

The need for specialized labor on fast line operations is caused by the fact that birds pass a given point at a rapid rate. This introduces some inefficiencies because all of the simple elements of processing must be accomplished at a given hourly output rate. The element of pace-setting for individual laborers enters into only those operations performed on the bird while it is on the line. Receiving; moving coops; usually giblet salvaging, cleaning, and wrapping; tucking legs; sizing; and packing were performed independently of the line. Extra help can be used to overcome temporary lags in output for these operations. If a worker could walk along with the bird, several of the simple operations on the line could be combined. As work space on the line was usually somewhat limited, however, walking along with the bird while it was being processed was impossible in most cases and walking back to the starting point would have involved lost motion. Also, assigning each worker regularly to a given operation permits the employee to develop great skill in the performance of that operation. For some employees observed, performance of their assigned operations seemed to be a reflex action.

Pinning was in general the only task that was performed while the operator followed the bird along the line. This was the most time-consuming operation observed, however, and simplification would be difficult. On only one line were individual birds passed from one pinner to another, thus preventing the need for walking along with the bird. The time required for walking back to the starting point on other lines was usually minimized by having the lines arranged rectangularly so that the pinners had only to step directly across the loop to begin pinning another bird. In some plants the pinners had to walk back along a straight line for as much as 15 feet.

Observations of the number of employees performing simplified operations and the general methods of crew organization on lines having various hourly outputs were made to determine adjustments in labor use required for different output rates. These observations were treated as confidential, and cannot be presented individually. Instead of this, approximate maximum output rates were derived from the observations. This information will be beneficial to

plant managers in north Georgia in evaluating the efficiency of their operations and to research workers in planning detailed input-output studies of broiler processing.

Apparently, the organization of a crew for maximum efficiency depends both on the total output and the speed of the line because of the effect of these factors on the need for simplified operations and on the number of employees required for such operations. The output per man-hour in performing these operations varied widely, and the observations did not reveal all the reasons for the variations. Labor requirements for the various operations will be discussed in the approximate order in which they were performed.

Moving Coops to Hangers

The labor used in moving coops to hangers was commonly adjusted by plant foremen in north Georgia by combining the assignment with other operations such as weighing, unloading from trucks, or moving coops from the feeding station. Records taken indicate that one man can handle up to 2,000 birds per hour if this operation is his one assignment. For plants having lower outputs additional tasks may be assigned a worker to increase the efficiency in the use of labor. At a higher hourly volume, additional help may be required. At this point the second man should be required to perform another task that would utilize most of his time. Layout of the plant, of course, would affect the number of coops moved.

Hanging Live Broilers

Generally, one employee can be expected to hang 750 broilers per hour although one individual observed was hanging 1,100 birds per hour. The lowest output rate observed was 500 birds per man-hour. As the rate at which shackles pass the hanger is constant, the operator cannot easily work ahead of schedule and thus free himself for other work on an intermittent basis. Nor can he utilize temporary assistance to enable him to catch up with a backlog of work. For this reason his labor can be most efficiently utilized only at hourly outputs of 750 birds. However, on the lines with low output rates this worker could possibly also remove the severed feet from shackles as they come out of the eviscerating room.

Killing

All lines observed in the area had 1 killer per 2,000 birds or less per hour. The killing operation cannot be easily combined with another operation, even on slow lines, because of the need for a constant elapsed time between killing and scalding. Therefore, the killer's time can be most efficiently utilized only at hourly outputs of 2,000 or multiples thereof. Skill in this operation is important, and incomplete bleeding can greatly reduce quality in the finished bird. Unskilled or slow-moving employees probably could not handle this number. Because of the importance of this job, a few plants paid the killers higher wages than they paid to other plant laborers.

Reversing

The first manual operation after killing was usually reversing the position of the birds in the shackles -- from being held by the feet to being held by the neck. This was done between the first rougher and the second rougher. The 12 lines that reversed the birds manually for reverse roughing used the same number of employees to change the birds from the neck hold back to the feet hold. The maximum output for this complete operation was about 600 birds per man-hour. On each of 5 lines only one person was required to guide heads into the track conveyor of the reverse roughers.

Buffing

Eleven lines employed persons to buff the birds. This operation consisted of manually placing the birds against the rubber fingers of rotating drums. On a few lines this work was performed by unshackling the birds, but ordinarily it consisted of placing the machines so that the birds could be manipulated without unshackling them. The output in this operation depends upon the use for which the buffer is intended. Most of the larger lines had a buffer to take care of barebacks only, and only one person was required to do the job under normal conditions. Three lines operating at 2,000 birds per hour or less used buffers in the place of mechanical strippers, and on these lines the output per man-hour was relatively low.

Pinning

Pinning was the most important single operation in the use of labor. Output ranged from 45 birds to 300 birds per man-hour, the output on 10 lines falling between 250 and 300. As was pointed out earlier, numerous factors affect the efficiency of this operation, the scalding temperature probably being most important.

Opening and Drawing

After being pinned the birds passed into an eviscerating area where the oil sac, feet, entrails, and necks were removed. In most plants the oil sac was removed first. The efficiency of this operation was as clearly related to the scale of operations as was the killing. Only one line had an output in removing oil sacs that exceeded 2,000 birds per man-hour. On lines operating at lower outputs than this, the worker removing the oil sac also quite often cut off one foot or made abdominal cuts.

Output in opening the birds ranged from 300 to 1,100 birds per man-hour. A single employee completely opened as many as 1,100 birds per hour. One line operating at about 3,000 birds per hour used three people, each of whom completely opened every third bird. On some lines opening was done by 2 successive operators, the first making 2 abdominal cuts and the second venting, but on most lines each of the 2 abdominal cuts was a specialized

operation. The maximum output per man-hour observed for these 3 specialized operations--2 abdominal cuts and venting--was 3,000 birds, but 1,500 to 1,800 was the more common output. Opening cannot be combined very readily with other operations on the line because of the necessary sequence of operations in eviscerating and because of the implement used.

Drawing viscera from the body cavity was an operation performed in numerous ways. However, an output of 600 birds per man-hour seems reasonable. Only on very slow lines could this be combined with opening or salvaging of giblets. Slitting the neck skin for ease in cropping can be performed at the rate of 2,700 birds per man-hour, cutting off necks at 1,800 birds per man-hour, and cropping and cleaning necks at 1,200. Combinations of these operations with others was observed quite frequently. An output per man-hour of 1,000 birds in removing lungs and reproductive organs was observed on 7 lines.

Giblet Operations

On some lines the livers were salvaged at one station and the gizzards and hearts at another. On these lines the salvagers either cleaned or partly cleaned the giblets. Output per man-hour in salvaging varied between 300 and 1,000 birds, but there was much less variation on lines operating above 2,500 birds per hour.

Cleaning giblets seemed to be a very complex and labor-using operation with wide variations in the output per man-hour. This job consisted of removing windpipes and gullets from the necks, splitting and peeling the gizzards, trimming the hearts, and washing the necks, gizzards, hearts, and livers. According to observations made, maximum outputs for specialized operations were as follows: Splitting gizzards, 2,000 per man-hour; washing gizzards, 1,500; peeling gizzards, 2,500; cleaning and washing other giblets, 3,000 per man-hour.

Wrapping giblets was fairly uniform between lines, and an output of 1,000 birds per man-hour seemed to be a reasonable maximum for this job. Stuffing the wrapped giblets into the body cavity was related entirely to the scale of operations, 1 person doing this on lines operating at 3,000 or less and 2 persons on lines with larger outputs. On several lines the person wrapping the giblets also stuffed them into the body cavity.

Tagging and Sorting for Size

Five miscellaneous operations were performed in connection with tagging and sorting for size - tagging the bird with the brand name, cutting off feet, removing feet from the shackles, tucking legs under the abdominal strap, and icing the holding vats. Sorting by size was done prior to icing and at a maximum rate of 2,500 birds per man-hour. An automatic sorter was used on 2 lines. Tagging was performed on only 8 lines, 7 of which were

operating at more than 2,000 birds per hour. Two people were assigned to tagging on each of the 8 lines. Cutting off feet was performed at a maximum rate of 1,500 birds per man-hour when this task was the only job of a worker. On some lines, the job was combined with other operations.

Tucking legs was performed at the rate of 1,500 birds per man-hour on a few lines; removing feet from the shackles, 2,500; and icing the birds and moving the chilling vats, 2,000. The output in icing and moving vats varied widely. One explanation for this is that, in general, the "floaters" helped with the icing of vats or with packing when not needed elsewhere and were probably considered as regular icers on some lines. Icing can be combined readily with packing operations, moving crates, or any other operation that can be performed intermittently.

Packing

Several operations were performed on some lines that were not observed on others. Boxmaking and grading were seldom performed in such a manner that labor requirements could be determined. On several lines, packing operations were performed by "floaters" or by regular employees at the cessation of other operations. The few observations of specialized packing operations that kept pace with the outputs of the lines may not be representative of labor requirements for packing. Apparently, 1 person can make boxes for an output of up to 3,200 birds per hour. Of 7 lines on which boxmaking was a specialized operation, 3 that processed 3,200 birds or less per hour had 1 boxmaker. Two boxmakers were employed on the four lines that processed more than 3,200 birds per hour.

Pulling undergrade birds off the line was performed at a maximum rate of 3,750 birds per man-hour, 1 line operating above this output and using two graders. Removing birds from the ice and passing them to the packers was performed at the hourly rate of 1,600 per man (new developments in vats have eliminated the need for this operation). Packing was performed at the same rate. Only 1 person was usually required to weigh and mark the boxes. Icing and closing the boxes were easily performed by 2 people. Only 2 lines were observed that employed more than 1 person for stacking the boxes on pallets.

Miscellaneous Operations

Output rates for supervision, cleanup, floating, management, and office help depend to some extent on the individual characteristics of the line's operation but do not increase much as the output of the line increases.

Total Labor Requirements for Specialized Assignments

The feasibility of using specialized labor for each of the 37 simplified operations essential to the processing of eviscerated broilers was examined

by approximating reasonable top levels of output per man-hour for each operation as performed in broiler processing plants in north Georgia. Standards could not be developed, because there was no measurement of the quality of inputs or outputs. The various outputs per man-hour established as maximums and the number of seconds devoted to each bird at those maximum levels of output are shown in table 12.

If each of the operations could be performed on a given line at the rate shown, the processing of each bird would require 88 seconds of labor, or 41 birds could be processed per man-hour. This is impossible, however, because the maximum rates for various operations do not coincide. At any reasonable output for a processing line, some workers would be working at less than the maximums shown. The assignment of 1 person or more to each of these 37 operations, therefore, is not always feasible, especially for slow lines, because of the lack of balance between the capacity of individual workers and the requirements of a number of tasks.

Table 13 shows the number of employees required to perform each of the 37 operations in processing and the time not utilized at various hourly outputs per line. On a line processing 500 birds per hour, 38 people would be required for specialized assignments, but not 1 of them would produce a maximum output. Only 12 of the 38 man-hours available for processing the 500 birds would be utilized because of the small output.

Conversely, on a line processing 3,000 birds per hour, 74 of the 87 man-hours available would be utilized. Assuming a wage rate of 75 cents per hour, costs of processing 3,000 birds per hour according to 37 specialized operations would be 2.2 cents per bird. For 500 birds per hour costs would be 5.7 cents. These figures show the necessity for combining operations on lines having small outputs.

Few lines observed in north Georgia simplified all operations as discussed above. Only the largest plants approached full specialization in individual assignments. Combining some operations and omitting others permitted the lines with small outputs to approach the level of labor efficiency achieved on large lines (table 14). Some operations omitted on small lines were tagging, careful sorting by weight, and strapping legs.

Limitations on Combining Operations

The speed of the line affects the ability of a manager to assign more than one operation to a given employee. The distance the bird travels per minute depends entirely on chain speed. With a given chain speed the hourly output could still be varied by changing the spacing between occupied shackles on the line (table 15). However, it would be impossible to make much change in either speed or shackle spacings in a given plant because of the necessity for a constant relationship between speed of the line and footage of machinery and between output and work space on the line. Lines with small outputs usually had wide spacings so that line speed would not

Table 12.- Maximum broiler output per man-hour and operational time, based on 19 lines, by operations, north Georgia, spring 1953

	Operation	Maximum broiler output per man-hour	Time required per bird
		Number	Seconds
1.	Moving coops	2,000	1.8
2.	Hanging	750	4.8
3.	Killing	2,000	1.8
4.	1st. reversing	1,200	3.0
5.	2d. reversing	1,200	3.0
6.	Buffing	4,600	.8
7.	Pinning	270	13.3
8.	Removing oil sacs	2,000	1.8
9.	Opening - large ventral cut	1,800	2.0
10.	Opening - small ventral cut	1,800	2.0
11.	Opening - venting	1,800	2.0
12.	Drawing viscera	600	6.0
13.	Slitting neck skin	2,700	1.3
14.	Cutting off necks	1,800	2.0
15.	Cropping	1,200	3.0
16.	Removing lungs	1,000	3.6
17.	Salvaging giblets	1,000	3.6
18.	Splitting gizzards	2,000	1.8
19.	Washing gizzards	1,500	2.4
20.	Peeling gizzards	2,500	1.4
21.	Cleaning other giblets	3,000	1.2
22.	Wrapping giblets	1,000	3.6
23.	Stuffing giblets into body cavity	3,000	1.2
24.	Tagging	2,300	1.6
25.	Inspecting body cavity	4,600	.8
26.	Cutting off feet	1,500	2.4
27.	Strapping legs	1,500	2.4
28.	Removing feet from shackles	2,500	1.4
29.	Icing and moving vats	2,000	1.8
30.	Making boxes	3,200	1.1
31.	Sizing	2,500	1.4
32.	Removing undergrades	3,750	1.0
33.	Unloading vats	1,600	2.2
34.	Packing	1,600	2.2
35.	Marking boxes	4,600	.8
36.	Icing and closing boxes	2,500	1.4
37.	Stacking boxes	4,600	.8
	All operations	41	1/ 87.8

1/ Not attainable on most lines for reasons given on page 40.

Table 13.- Number of employees required and potential work capacity not utilized by specialized operations at specified levels of broiler output 1/

Operation 2/	Maximum broiler output per man-hour	Hourly broiler output of conveyor lines: 500		1,000		3,000		3,025		4,000	
		Workers required	Time not utilized	Workers required	Time not utilized	Workers required	Time not utilized	Workers required	Time not utilized	Workers required	Time not utilized
	Number	Number	Hours	Number	Hours	Number	Hours	Number	Hours	Number	Hours
1. - - - -	2,000	1	0.75	1	0.50	2	0.50	2	0.49	2	---
2. - - - -	750	1	.33	2	.67	4	---	5	.97	6	0.67
3. - - - -	2,000	1	.75	1	.50	2	.50	2	.49	2	---
4. - - - -	1,200	1	.58	1	.17	3	.50	3	.48	4	.67
5. - - - -	1,200	1	.58	1	.17	3	.50	3	.48	4	.67
6. - - - -	4,600	1	.89	1	.78	1	.35	1	.34	1	.13
7. - - - -	270	2	.15	4	.30	12	.89	12	.80	15	.01
8. - - - -	2,000	1	.75	1	.50	2	.50	2	.49	2	---
9. - - - -	1,800	1	.72	1	.44	2	.33	2	.33	3	.78
10. - - - -	1,800	1	.72	1	.44	2	.33	2	.32	3	.78
11. - - - -	1,800	1	.72	1	.44	2	.33	2	.32	3	.78
12. - - - -	600	1	.17	2	.33	5	---	6	.96	7	.33
13. - - - -	2,700	1	.81	1	.63	2	.89	2	.88	2	.52
14. - - - -	1,800	1	.72	1	.44	2	.33	2	.32	3	.78
15. - - - -	1,200	1	.58	1	.17	3	.50	3	.48	4	.67
16. - - - -	1,000	1	.50	1	---	3	---	4	.98	4	---
17. - - - -	1,000	1	.50	1	---	3	---	4	.98	4	---
18. - - - -	2,000	1	.75	1	.50	2	.50	2	.49	2	---
19. - - - -	1,500	1	.67	1	.33	2	---	3	.98	3	.33
20. - - - -	2,500	1	.80	1	.60	2	.80	2	.79	2	.40
21. - - - -	3,000	1	.83	1	.67	1	---	2	.99	2	.67
22. - - - -	1,000	1	.50	1	---	3	---	4	.98	4	---
23. - - - -	3,000	1	.83	1	.67	1	---	2	.99	2	.67
24. - - - -	2,300	1	.78	1	.56	2	.70	2	.68	2	.26
25. - - - -	4,600	1	.89	1	.78	1	.35	1	.34	1	.13
26. - - - -	1,500	1	.67	1	.33	2	---	3	.98	3	.33

Continued--

Table 13.- Number of employees required and potential work capacity not utilized by specialized operations at specified levels of broiler output 1/-Continued

Operation 2/	Maximum broiler output per man-hour	Hourly broiler output of conveyor lines: 500		1,000		3,000		3,025		4,000	
		Workers required	Time not utilized	Workers required	Time not utilized	Workers required	Time not utilized	Workers required	Time not utilized	Workers required	Time not utilized
	Number	Number	Hours	Number	Hours	Number	Hours	Number	Hours	Number	Hours
27. - - -	1,500	1	0.67	1	0.33	2	---	3	0.98	3	0.33
28. - - -	2,500	1	.80	1	.60	2	0.80	2	.79	2	.40
29. - - -	2,000	1	.75	1	.50	2	.50	2	.49	2	---
30. - - -	3,200	1	.84	1	.69	1	.06	1	.05	2	.75
31. - - -	2,500	1	.80	1	.60	2	.80	2	.79	2	.40
32. - - -	3,750	1	.87	1	.73	1	.20	1	.19	2	.93
33. - - -	1,600	1	.69	1	.38	2	.12	2	.11	3	.50
34. - - -	1,600	1	.69	1	.38	2	.12	2	.11	3	.50
35. - - -	4,600	1	.89	1	.78	1	.35	1	.34	1	.13
36. - - -	2,500	1	.80	1	.60	2	.80	2	.79	2	.40
37. - - -	4,600	1	.89	1	.78	1	.35	1	.34	1	.13
Total	---	38	25.63	42	17.29	87	12.90	97	22.30	113	14.05
		Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Cost of labor at 75 cents per hour		28.50	19.22	31.50	12.97	65.25	9.68	72.75	16.72	84.75	10.54
Cost per bird 3/		.057	.038	.032	.013	.022	.003	.024	.006	.021	.002

1/ Number of employees required for assignment to each operation based on maximum output rates in table 12.
2/ The numbers shown here correspond to the operation numbers shown in table 12.
3/ Cost of labor per bird for time utilized was $0.018.

Table 14.- Hourly output of processed broilers per laborer, 15 nonfederally inspected broiler processing lines, north Georgia, spring 1953

Hourly broiler output	Lines observed	Average employees per line	Average broiler output per hour	
			Per line	Per employee
	Number	Number	Number	Number
250 - 1,249	4	28	800	28
1,250 - 2,749	3	73	2,067	28
2,750 and over	8	108	3,674	34
Total or average	15	80	2,586	32

Table 15.- Hourly output of broilers on processing conveyor lines, by specified combinations of chain speed and shackle spacings

Chain speed per minute	Inches between occupied shackles					
	5	6	8	10	12	15
Feet	Number	Number	Number	Number	Number	Number
9 1/	---	---	---	648	540	432
12	---	---	1,080	864	720	576
15	---	1,300	1,350	1,080	900	720
18	2,592	2,160	1,620	1,396	1,080	864
24	3,456	2,880	2,160	1,728	1,440	---
30	4,320	3,600	2,700	2,160	---	---
36 2/	5,184	4,320	3,240	---	---	---

1/ This speed may cause the birds to stay in machinery too long.
2/ This speed may move the birds at excessive rates for both machinery and labor operations.

fall below 12 to 15 feet per minute and thus leave birds in automatic machinery for excessive periods. Lines with large outputs spaced birds closely and regulated line speed to not more than 35 to 40 feet per minute to permit workers to perform most operations at a given point on the line.

Breaking Points in Output per Worker

On lines processing more than 1,000 birds per hour the distance a bird moves during a number of operations was probably great enough to require the

simplification of those operations. At the same time the use of labor for specialized assignments was relatively inefficient at these low output rates (table 16).

Table 16.- Employees required, broiler output per hour per employee, and the effect on output of additions to the labor crew, by specified range in broiler output per hour 1/

Range in broiler output per hour	Employees required	Broiler output per hour		
		Per employee		Added output per added employee
		Low	High	
Number	Number	Number	Number	Number
1,001 - 1,080	45	22	24	27
1,081 - 1,200	46	24	26	120
1,201 - 1,350	50	24	27	38
1,351 - 1,500	51	26	29	150
1,501 - 1,600	55	27	29	2/ 20
1,601 - 1,620	57	28	28	2/ 10
1,621 - 1,800	58	28	31	180
1,801 - 1,890	63	29	30	2/ 18
1,891 - 2,000	64	30	31	110
2,001 - 2,160	72	28	30	2/ 20
2,161 - 2,250	73	30	31	90
2,251 - 2,400	75	30	32	75
2,401 - 2,430	79	30	31	2/ 8
2,431 - 2,500	80	30	31	70
2,501 - 2,700	84	30	32	50
2,701 - 2,970	86	31	35	135
2,971 - 3,000	87	34	34	2/ 10
3,001 - 3,200	97	31	33	2/ 20
3,201 - 3,240	100	32	32	2/ 13
3,241 - 3,510	101	32	35	270
3,511 - 3,600	102	34	35	90
3,601 - 3,750	110	33	34	2/ 19
3,751 - 3,780	112	33	34	2/ 15
3,781 - 4,000	113	33	35	220
4,001 - 4,050	121	33	33	2/ 6
4,051 - 4,200	122	33	34	150
4,201 - 4,320	123	34	35	120
4,321 - 4,500	124	35	36	180
4,501 - 4,590	128	35	36	2/ 22
4,591 - 4,600	129	36	36	2/ 10

1/ Based on maximum rates of output per worker in table 12, assuming specialization of each of the 37 operations.

2/ A reorganization of the magnitude shown on the designated lines is unprofitable.

At this point it must be stressed again that no specified output will permit full utilization of each employee who performs specialized tasks. The maximum output for each assignment is different, ranging from 270 birds per hour for pinning up to 4,600 birds per hour approximately for weighing and marking boxes. At large hourly outputs, however, the average utilization of available labor is improved. The failure to utilize fully the labor of 1 employee out of 50 is much less serious than the failure to utilize fully the labor of 1 employee out of 25. Finally, it is important to remember that the utilization of processing labor does not increase at a uniform rate as plant output increases. There is a maximum output for each crew, and at this point, labor costs for this crew are at a minimum.

An extreme example of the effect of simplification and specialization of operations on output per worker is provided by the 8 packing operations. Specialization would require 8 people to pack any hourly output up to 1,600 birds per hour. Output per worker would vary from 0 to 200 birds per hour. To pack more than 1,600 but not more than 2,500 birds per hour, 2 people would have to be added to the packing crew--1 to help take the birds out of the chilling vats and another to help pack.

For packing more than 2,500 birds, 2 more people would probably have to be added to assist in sizing and in closing boxes. Maximum efficiency for the crew as a whole would not be reached at any reasonable level of output, but efficiency would generally rise as scale of operations increased. At an hourly output of 4,600 birds, output per man-hour of specialized labor would be 288 birds compared with 200 birds per man-hour at an hourly output of 1,600 birds. This is probably the reason why few packing operations were specialized. These few were not always synchronized with the output of the conveyor lines.

Data in table 13 further show the effect on labor costs of increasing output of the line per hour at certain points where several maximums coincide. On a line processing 3,000 birds per hour the output per worker was 34 birds per hour. Hanging, drawing, lung pulling, giblet salvaging, cleaning giblets, giblet wrapping, giblet stuffing, cutting feet, and strapping legs would all be performed as efficiently as possible, assuming that the maximums per man-hour shown in table 12 are reasonable. Any further increase in line output would necessitate the addition of 1 employee to each of these operations.

With an increase in line output of only 25 birds per hour, the labor of the 10 employees added to permit this increase would scarcely be utilized although there might be more complete utilization of labor on other operations. The output per man would drop to 31 birds per hour. Costs of labor on the line would go up by 0.2 cent per bird. This would amount to an added labor cost of roughly $50 per 8-hour day.

By increasing the output by 500 birds, thus bringing the total to 3,500, and adding an employee to assist in pinning, another to box making, a third to removing birds from vats, and a fourth to packing, the output per man-hour would increase to 35 birds, and costs would be reduced 0.3 cent per bird

over costs at an hourly output of 3,025 birds. (Costs would be 0.1 cent per bird under the previous peak in efficiency reached with 87 employees and an hourly output of 3,000 broilers)(table 16).

Reorganizing Crews for Maximum Efficiency

Variations in output per worker at different levels of hourly output with crews of specified sizes are shown in table 16. In the column headed "Output per employee" it can be seen that peaks in efficiency are reached at hourly outputs close to 3,000 birds per hour; again, at 3,500 birds per hour; and, then, at 4,000, 4,320, and higher outputs. At other levels of hourly line output such as 3,240 and 4,050, the output per man-hour is considerably lower.

It is not expected that the particular figures shown in this table will apply to every line. However, it is believed that there are a number of breaking points for any one line at which the addition of new employees to permit increases in hourly output would improve or reduce the output per man-hour. The adjustment which can be made in hourly output for a particular line is, of course, limited because of the existing capacity of the scalder and other machinery and work space.

Before making an adjustment in the organization of a given crew, however, a plant manager should first decide whether he will be able to increase the hourly output for the line as a whole to a point that will permit an increased output per worker and result in reduced cost of labor per bird. If this increased hourly output would overtax the capacity of the scalding tank or of the picking machines and work space, he should consider reducing hourly output so as to obtain a more optimum use of labor. And he might offset the reduced hourly output by working more hours per week if such a schedule were possible.

The factors affecting this decision will be peculiar to each individual plant or line and should be based upon the experience of the manager in that plant rather than upon figures shown herein. Although these figures are typical, they do not take into account the skill of the individual employees involved nor the limitations of the individual plant layout and equipment.

It is believed that the above comments explain why certain processing lines in north Georgia used more labor per unit of output than did their competitors in the area. The operations which seemed to be most variable in use of labor were: Moving coops, hanging (particularly on fast lines), pinning, removing lungs, giblet salvage, cleaning giblets, wrapping giblets, folding legs, icing vats, and packing the birds in the boxes. In every case where coop moving utilized more labor than seemed necessary from observations on other lines, this excess could be attributed, at least in part, to the layout of the plant. The receiving or holding space for live birds was some distance from the hanging station. The same was true of plants seeming to use excess labor in the icing and moving of chilling vats.

Each plant manager should evaluate the operations in his plant in terms of the approximate standards shown herein. Further study is needed of the relationships between various mechanical and physical factors and pinning time, and between quality of output and labor requirements for several eviscerating operations before final standards or conclusions can be stated. A study should also be made of the feasibility of reorganizing the size and assignments of crews to increase their efficiency as supplies of broilers or of labor vary.

Labor and Machinery Use on Federally Inspected Lines

The preceding discussion of variations in labor and machinery use in processing broilers in north Georgia includes no reference to observations on federally inspected lines. This is because no measure of the quality of inputs and outputs was obtained, and the inclusion of such lines would not have extended the range of hourly outputs observed.

For this preliminary study it was not considered feasible to arrive at an objective measure of the quality of the operations on federally inspected and nonfederally inspected processing lines. Observations could have been made with respect to the number of feathers which remained on certain parts of the body or with respect to the number of birds in which there were parts of inedible viscera or signs of poor workmanship. However, it would have been necessary to make detailed observations on all of the lines of the quality of the end product before drawing any conclusions as to the profitableness or efficiency of one type of line over another. The effective market demand schedule for each product would also have to be determined before concluding that one type of line is more profitable than another.

The rules and regulations of the Federal Inspection Service are designed to result in sanitation in processing. A federally licensed inspector examines each bird and its viscera and discards birds with evidences of certain diseases. He can direct the trimming of certain bruised places on otherwise good birds after which the sale of the remainder of such birds is permitted as cut-up parts. Although the Inspection Service does not attempt to specify the techniques used in processing, it outlines certain requirements which must be met.

The following examples of these requirements are typical but not necessarily complete. The Inspection Service requires that the neck skin be slit so that the crop can be loosened and removed without being ruptured to lower the possibility of the bird's being contaminated with the contents of the crop. This was done on nonfederally inspected lines in Georgia also. In opening and drawing, care must be taken that the viscera be identified with the bird -- either be placed in separate pans or remain attached to the bird until inspection can take place. This is done to enable the inspector to discard the carcasses from which diseased viscera came.

Under Federal inspection the hearts and livers must be trimmed to remove bile stain and excess blood vessels. In general, the Inspection Service requires employees to work at such speed and in such fashion that they can keep themselves and their tools clean and can do a workmanlike job.

In the spring of 1953, Federal inspection apparently cost processors more per unit of output in north Georgia than did nonfederally inspected processing. This was due to a number of factors. The 12-inch shackle spacings were allowed on the separate eviscerating lines. These spacings added to the requirements for conveyor footage and floor space per unit of capacity over the 6-inch spacings of most of the nonfederally inspected lines. There were an inspection table and controls by which the inspector could stop the line (such stoppage adding to lost labor), specially constructed plants, and so on. All of these added to higher overhead costs of processing per unit of capacity.

Twelve of the operations required more labor on at least 2 of the 5 inspected lines than did the typical nonfederally inspected line operating at the same hourly output. For 4 of these operations the added use of labor on inspected lines was not explainable by the methods required by the Federal Inspection Service. These were moving coops, hanging, and reversings. The other 8--buffing, pinning, opening, drawing, cropping, removing lungs, giblet salvage, and the cleaning of other giblets--might be due, in part at least, to the requirements of the Inspection Service. These operations were usually specialized on the federally inspected lines, whereas they were quite often performed in combinations on nonfederally inspected lines having similar outputs.

In addition to these operations there were a few performed on lines having Federal inspection that were not performed on other lines. These included the services of the inspector and his assistant, transfer of the birds from the dressing line to the eviscerating line, careful supervision of the evisceration, and manual removal of the heads. These additional operations required 7 employees on each of 2 lines and 4 employees on each of the other 3.

These cost disadvantages were probably offset to some degree by price premiums based on the assurances to the buyers of a wholesome product. The buyers did not have to examine the plant's operations or the conditions of purchases in order to assure themselves of this. Also some out-of-State markets prefer federally inspected broilers.

However, the reader must not assume that birds processed in nonfederally inspected plants are necessarily unwholesome. For example, nonfederally inspected plants in north Georgia were operating under "plant inspection" which resulted in processed birds that met their buyers' requirements, and buyers visit the plants frequently.

It was the responsibility of the plant foreman to keep constant watch over the wholesomeness and quality of the output. On faster lines the plant foreman stationed employees at various points to assist him in this inspection, one for the pinning operation, another for the evisceration, another to discard bad carcasses and grade out low quality birds. Each bird was usually examined for pieces of oil sacs, pinfeathers, fragments of lungs, windpipes, crops, or other inedible material in the body cavity and material

from ruptured crops or split intestines. These defects, with the exception of pinfeathers, are undesirable because they may contaminate or hasten deterioration in the carcasses. If not eliminated they could be observed by the buyers and would result in dissatisfaction if not in price discounts.

Other possible objectionable characteristics are not so evident to the untrained employee and must be prevented or corrected by proper practices. These characteristics affect sanitation rather than the appearance of the product. Contamination of healthy birds from unhealthy birds is caused by mingling giblets and other viscera from many birds and by contact with soiled hands and tools. The use of unwashed utensils, careless practices in handling completely eviscerated birds, and improper chilling procedures can be controlled by the watchful foreman by instituting standards of processing.

Further study is needed to develop a desirable combination of operations for various members of the crew on lines having Federal inspection so that the output per hour of the line can be adjusted to the needs of the inspector without adversely affecting labor costs.

ECONOMIES OF SCALE OF OPERATIONS

It has been demonstrated in other areas that scale of operations involving outputs of up to 1,100 broilers per hour in broiler processing affects the average fixed and variable overhead costs. This relationship holds even when plant capacity is not fully used. A high utilization of capacity on a particular line, is, of course, important if overhead costs are to be kept down on a per unit basis. This relationship of scale of operations to average costs was demonstrated by synthesizing five model plants of different sizes with "ideal" layouts and arrangements and computing the fixed and variable costs of each, assuming a uniform level of hourly output and of supervisional, managerial, and labor ability 9/.

The theoretical study discussed above showed that labor efficiency increased as the scale of operations increased. In a plant that dressed, eviscerated, and cut up 500 broilers in an 8-hour day, the output per man-hour was computed as 12.5 broilers. For a plant processing 9,000 broilers per day on one line the output per man-hour was computed as 19.4 broilers. Plants of larger daily output were not examined. This study also showed that total cost per broiler varied from 16.6 cents for the smallest plant to 11.8 cents for the largest plant when both were operating at 100 percent utilization of capacity. These costs do not include shrinkage. Comparable costs were developed in a study of cooperative poultry dressing plants 10/.

9/ Baum, E. L., Faris, J. E., and Walkup, H. G., "Economies of Scale in the Operation of Fryer Processing Plants." Wash. Agr. Expt. Sta. Tech. Bull. No. 7, Pullman, Wash., August 1952.

10/ Eastwood, R. A., and Scanlan, J. J., "Operating Cost of 15 Cooperative Poultry Dressing Plants." Farm Credit Administration, USDA, Bull. 70, Washington, D. C., June 1952.

The study of broiler processing in the north Georgia area covers a scale of operations that starts (for commercial operations) rather than stops at 1,100 birds per hour. It confirms the principles demonstrated by earlier studies, however, and shows that economies of scale of operations, with the exception of certain breaking points, were obtained in the use of labor and the use of equipment, within reasonable levels of output. The utilization of plant capacity is particularly important in Georgia where the investment in plant and equipment is large. Although there was some range in the utilization of capacity between plants within certain size groups, there was good indication that larger plants utilized more of their capacity in 1952 than did smaller plants (table 17). On the average there was a 5.8 percent increase in capacity utilization for each increase in hourly output of 1,000 broilers.

Table 17.- Maximum and normal capacity and utilization of capacity, 28 commercial broiler-processing plants, north Georgia, 1952

Hourly output of broilers	Plants	Annual average broiler capacity		Percentage utilization of capacity	
		Maximum	Normal	Maximum	Normal
	Number	Thousands	Thousands	Percent	Percent
250 - 1,249 1/	10	1,674	1,512	59	65
1,250 - 2,749 1/	6	4,715	4,440	78	83
2,750 and over 2/	12	8,615	7,724	82	91
Total or average	28	5,300	4,802	78	87

1/ All data estimated for one plant.
2/ All data estimated for two plants. Output for one plant estimated from its records for the fourth quarter of 1952. Output of one plant estimated.

Cost figures were not obtained from north Georgia processors. Despite this it is possible to reach tentative conclusions regarding economies of scale of operations in the area. For these purposes costs can conveniently be divided into about six categories. They are assembling, labor, overhead, packaging materials, selling expense, and hauling. Three of these items--assembling, packaging materials, and hauling--should be somewhat constant between plants on a per-pound or per-mile basis. In the larger plants some reduction in costs could probably be made even in those items.

In connection with procurement, for example, large plants can haul the live broilers from farms to plant in large truckloads without undue shrink. In addition, contacts with producers of large flocks or with dealers whose

operations cover a large number of producers should lower cost of communications. The cost of packing materials may be reduced as the scale of operations increases if there are price discounts for purchases in large quantities. Communications with the receivers are also in terms of large numbers.

Costs of labor were reduced as the scale of operations increased, even though records obtained from the north Georgia plants indicate that some of the small lines were operated at relatively high levels of efficiency insofar as labor was concerned. This was partly due to the omission of some of the operations performed on larger lines. As a rule, however, the large lines turned out more broilers per man-hour than did the smaller ones. And, because of the enormous poundage processed in a day on the larger lines, the small difference per unit could add up to quite a large item in terms of dollars and cents. The number of broilers processed in relation to the number of executives and office workers was higher for the large plants also (table 18). It is evident that lines processing more than 3,000 broilers per hour had lower labor costs than did the lines operating at about 1,000 birds per hour.

Table 18.- Hourly output of processed broilers per executive and office worker in 15 nonfederally inspected broiler-processing plants, north Georgia, spring 1953

Hourly plant output of broilers	Plants	Executives and office workers per plant	Hourly broiler output per -	
			Plant	Executive and office worker
	Number	Number	Number	Number
250 - 1,249	5	2.2	796	362
1,250 - 2,749	4	7.5	2,225	297
2,750 and over	6	7.2	3,454	480
Total or average	15	5.6	2,240	400

Overhead needs appear to show some effects of scale of operations. The larger lines processed more broilers per hour per foot of conveyor length on the average than did the smaller lines (table 19). This economy of conveyor line footage on large lines as compared with the smaller ones is due to two things, relatively fewer employees and relatively fewer feet of machinery per bird processed.

Economies in machinery as scale of operations increased are indicated by the fact that machines of only a few lengths were observed. Full utilization of any given machine would occur at only one hourly output. Actual economies could not be shown from observations because of the extreme variations in type and amount of machinery.

Table 19.- Hourly broiler output per line and per foot of specified operations on overhead conveyor of 11 nonfederally inspected processing lines, by specified output per line, north Georgia, spring 1953

Hourly broiler output per line and area	Lines	Average length of conveyor per line	Average hourly broiler output	
			Per line	Per foot of conveyor
	Number	Feet	Number	Number
250 - 2,749				
Hanging and killing -		37.0		37
Dressing - - - - - - -		133.0		10
Eviscerating - - - - -		86.0		16
Total or average	5	256.0	1,360	5
2,750 and over				
Hanging and killing -		72.5		46
Dressing - - - - - - -		254.0		13
Eviscerating - - - - -		157.5		21
Total or average	6	484.2	3,338	7
Grand total or average	11	380.0	2,439	6

The above observations would indicate that there are cost advantages in large-scale operations. The opportunity to reduce cost on a per-unit basis as volume processed per hour in the plant increases provides an incentive for the construction of large plants. Such incentive must be tempered by the realization that low utilization of capacity could result in average overhead costs of such magnitude that they would offset the potential savings possible in large-scale operations. Enough production must be available to maintain processing plants at or near full capacity before the economies of large operations can be effective in reducing per unit costs of processing.

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